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GOVERNMENT OF INDIA

MINISTRY OF HEALTH

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REPORT

of the

ENVIRONMENTAL HYGIENE COMMITTEE

OCTOBER, 1949

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FROM

DR. B. C. DAS GUPTA,

Chairman, Environmental Hygiene Committee.

To

THE SECRETARY to the GOVERNMENT OF INDIA,

MINISTRY OF HEALTH,

NEW DELHI.

No. 1-48/48-E.H.C. *Dated New Delhi, 18th October, 1949*

SIR,

With reference to the Ministry of Health letter No. 2-22/48-PR, dated the 16th June, 1949, I have the honour to forward herewith the Report of the Environmental Hygiene Committee.

2. We have completed the task assigned to us in the shortest time possible under the limitations in which we could meet, collect data and deliberate on the many complex problems falling within our terms of reference.

3. I wish we had been able to submit this Report six months earlier when the prospects of the implementation of National plans were brighter from the financial point of view. That was not possible.

4. However, we would earnestly plead for very early implementation of the plans outlined by us as they are so intimately bound up with the health, productivity and happiness of the nation.

5. The members of my Committee and I thank you for the privilege of having been asked to draw up a plan for environmental hygiene.

Yours faithfully,

B. C. DAS GUPTA,

Chairman

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REPORT OF THE ENVIRONMENTAL HYGIENE COMMITTEE

CHAPTER I.

I. INTRODUCTION.

The Environmental Hygiene Committee was constituted by the Government of India, Ministry of Health, in June 1948, primarily to consider the steps to be taken to implement the recommendations of the Health Survey and Development Committee contained in Chapter XII, Volume II, of their report in regard to environmental hygiene.

2. The following persons were appointed to serve on the Committee (*vide* letter No. F. 3-22/48-PR, dated 16th June 1948, from the Ministry of Health to Dr. B. C. Das Gupta, Chairman of the Committee) :—

Chairman

(1) Dr. B. C. Das Gupta, Deputy Director-General of Health Services, New Delhi (now Executive Health Officer, Bombay Municipality).

Members

(2) P. C. Bose, Esquire, Chief Engineer, Public Health Engineering, Government of West Bengal, Calcutta.

(3) R. S. Mehta, Esquire, Superintending Engineer, Health Services, Delhi.

(4) N. V. Modak, Esquire, Special Engineer, Bombay Municipality, Bombay.

(5) A. V. Raman, Esquire, Editor, People's Health, Madras.

(6) K. Subrahmanyan, Esquire, Professor of Public Health Engineering, All-India Institute of Hygiene and Public Health, Calcutta.

Mr. Raman resigned from the Committee in September 1949 on grounds of Health. Mr. G. C. Mitroo of the Ministry of Health, New Delhi, was appointed Secretary.

3. The Committee was empowered to co-opt suitable members to assist in the examination of particular problems and to tour whenever necessary.

4. The terms of reference to the Committee were :—

"(*i*) Investigation of the whole field of Environmental Hygiene with special reference to

(*a*) town and village planning ;

(*b*) housing, urban and rural ;

(*c*) water supply ;

(*d*) general sanitation, including conservancy and drainage ;

(*e*) prevention of river and beach pollution ;

(*f*) control of insect vectors of diseases ; and

(*g*) regulation of certain trades, industries and occupations dangerous to health and offensive to the community.

(*ii*) The framing of a programme of development for the consideration of Government based on an examination of the recommendations of the Health Survey and Development Committee regarding Environmental Hygiene and of the Five-Year Plans of Provinces.

In framing the programme, the Committee should take into consideration the following factors :—

(*a*) the programme will require to be placed on a basis of adequate and comprehensive planning while at the same time taking into account the financial capacity of Governments to implement the programme. The Committee should, therefore, suggest, wherever possible, ways and means by which the funds necessary for implementing their proposals can be found.

(*b*) the need for promoting the training of an adequate number of technical personnel of various categories required for a modern programme of environmental improvement and for promoting the production of the necessary equipment. The Committee should make specific recommendations in this regard.

(*c*) In view of the varying resources of the Provinces, the measures required to assist the less favoured Provinces so that the programme can be implemented on as uniform a basis as possible."

In the Ministry of Health letter No. Dy. 1497-PR/49, dated 3rd September 1948, the Committee was asked to "investigate the advantages of composting in preference to other methods of disposal of urban refuse and make suitable recommendations."

5. The terms of reference cover a vast range of subjects, both technical and financial. Although the Committee was expected to report as early as possible, the members have their normal official duties ; the time they can

spare for touring and deliberations in Committee is limited, and it has not been possible to report earlier. After drafting the technical part of the recommendations, we co-opted Mr. T. T. Krishnamachari, Members of the Constituent Assembly, who is also a Member of the Drafting Committee of the Constitution and a Member of the Standing Finance Committee, to advise us on financial aspects. We have incorporated his valuable suggestions in our report.

6. The first meeting of the Committee was held in New Delhi on the 25th and 26th June 1948, when the proceedings were inaugurated by Dr. K. C. K. E. Raja Director-General of Health Services. After hearing messages from His Excellency the Governor-General and the Hon'ble Minister for Health, the Committee entered upon its task, and discussed in details a comprehensive draft questionnaire kindly prepared by Mr. A. V. Raman. The questionnaire was adopted with minor alterations, and was printed and issued in August 1948 to nearly 1,000 authorities and persons in the various provinces and States in India. The questionnaire is appended (Appendix 1). Replies were received only from 160 persons, whose names are detailed in Appendix II.

7. After allowing sufficient time for collecting replies to the questionnaire, the Committee began its tours. These could not be undertaken at a stretch for the reason that members could get away from their places of work only for short periods. The Committee toured the Bombay Province in October 1948, Madras Province and Mysore State in January 1949, West Bengal, Bihar and Assam in February—March 1949, Orissa, Hyderabad, the Central Provinces and the United Provinces in May 1949, the East Punjab in June 1949 and Delhi Province in October 1949.

8. In each of these tours the Provincial Governments and States were requested to arrange for interviews with such persons, official and non-official as were in a position to assist the Committee in its task with their views and experience on any aspect of the environmental hygiene. The list of persons interviewed will be found in Apendix III. Most of them had sent in written memoranda and their oral evidence was valuable.

9. The Provincial Governments and States were also requested to arrange for visits by the Committee to representative works concerning environmental sanitation, such as housing and town planning schemes, rural development and reconstruction work, water and sewage works, factories, mines, plantations, etc. These visits were instructive.

10. The Committee had the privilege of being invited to the first Conference of Improvement Trusts and Development Boards that was convened by the Government of India, Ministry of Health, in Delhi in the last week of June 1948 and taking part in discussions on housing and town planning. These two subjects form an important part of environmental hygiene. The views we heard and the contacts we made at that Conference were valuable in our work.

11. The range of subjects referred to us is very wide and they are all important. We have studied the reports of others who have been devoting some thought to some of these subjects. The foremost among these is the Report of the Health Survey and Development Committee (1946) which has emphasised the influence of environment on (1) the chances of exposure of man to infectious agents of diseases, and (2) man's positive health, cheer, efficiency and usefulness to himself, his family and the State. The Health Survey and Development Committee has drawn the broad outlines of planning for a national health service, integrating curative and preventive work, and including in the latter plans for housing, village and town planning, water supply, disposal of excreta, general sanitation, control of river and beach pollution, control of insects, rodents and other vectors of diseases, and control of dangerous and offensive trades. However, it says : " We have had neither the time nor the opportunities for a detailed consideration of these problems. We are therefore confining ourselves largely to certain general principles leaving their application to be decided after a review of the local considerations in each case." That Committee has made certain valuable recommendations on some items, and defined broadly the targets, programmes and financial implications regarding some items such as housing, Water Supply and Sewage. These will be referred to in the relevant chapters of our report.

12. We have studied the reports of the National Planning Committee on National Housing, Public Health, Education, Chemical Industries, etc., and the " Bombay Plan " of the industrialists.

13. We have also read the report of the " Mitra Committee ", appointed by the Railway Board, on " the scheme for the provision of quarters for the Railway staff " (1946). Most of the recommendations made by this Committee have been accepted and are being implemented in the new constructions of the India State Railways.

14. We have read the report of the Industrial Housing Sub-Committee of the Standing Labour Committee of the Government of India (1946). These recommendations have also been largely accepted, and we have seen the work done in implementation of the same.

15. We have also studied the report of the Madras Provincial Housing Committee (1948). This is a very valuable report. Unlike many others, it does not stop with general enunciations but has gone into details of needs, costs, materials and resources. It deals with the subject from a practical point of view.

16. We have studied the report of the Housing Panel of the Committee on Greater Bombay (1946), which is also a valuable and practical document. We have seen also the activities of the Directorate of Housing, Bombay, in implementation of this report.

17. We have read the report of the Co-operative Planning Committee (1946), appointed by the Government of India, Department of Education, Health and Lands, particularly the Chapter on " housing, health and better living ".

18. We have read the report of the First Conference of Improvement Trusts and Development Boards (1948).

19. We have read the report on " The Health of the Industrial Worker in India " (1946 by Dr. T. Bedford of the Industrial Health Research Board of the Medical Research Council in the United Kingdom and the Report of the Labour Investigation Committee (Rege Committee) together with its many *ad hoc* survey reports (1946) on the conditions obtaining in Industries. We have have also read the Report of the Royal Commission on Labour in India (Whetley Commission), 1931.

20. On the subject of water supplies and drainage, we have studied the memoranda submitted to the Health Survey and Development Committee and the recommendations of the Madras Water Supply and Drainage Committee.

21. On the subject of training technical personnel, we have studied the Health Survey and Development Committee's recommendations, the proceedings of the All-India Council for Technical Education of the Government of India, Ministry of Education (printed as Bureau of Education pamphlets), and the report of the Sub-Committee of the Public Health Engineering Education Committee, University of Madras.

22. We have studied the legislative enactments relating the public health, town planning, and gram panchayats, which are either in force or contemplated in the various Provinces and States. The possibility of utilising the gram panchayats that are being set up in most provinces as effective instruments for improving the rural environment has also been considered in drafting our report.

23. We have studied also the ambitious, post-war five-year plans of the provinces.

24. It will be gathered from the above that many Committees have been considering housing and town planning, either for limited departmental purposes or for local purposes. They have not all been co-ordinated. Some of the five-year plans of provinces appear to have been drawn up in too short a time.

25. We want to place on record our profound gratitude to the officers of the Central, Provincial and State Governments, to different local Bodies, Improvement Trusts and their officers for all help and facilities provided to us in connection with our visits, inspections, etc. We are also grateful to those technical and administrative experts who have given us the assistance of their views either through their evidence before our sessions or by replies to the questionnaire issued by us.

26. The gratitude of the Committee cannot be adequately expressed to Prof. Subrahmanyan, who very kindly undertook to prepare the draft report. Environmental Hygiene is by and large Public Health Engineering and as such the preparation of the draft report had to be entrusted to an expert Public Health Engineer who by virtue of his extensive knowledge, experience and

vision could handle the task in its technical aspects. The Chairman feels he has imposed unduly on his long-standing friendship with the Professor in requesting him to undertake this work in the midst of his heavy duties in the Institute of Hygiene and elsewhere. He therefore acknowledges very gratefully this fresh act of kindness from his old friend.

27. The Committee is also grateful to Mr. T. T. Krishnamachari who was co-opted for advice on financial aspects. Our discussions with him were most useful. His valuable suggestions have been incorporated in our report.

28. It is a matter for regret that Mr. Raman had to resign on grounds of health. The elaborate questionnaire (Appendix I) had been prepared by him before we held our first meeting and this was a great help to us. In our meetings and tours before he resigned, we had many opportunities of discussing with him problems of Environmental Hygiene and considering his valuable views and suggestions.

29. We should like to express our warm appreciation of the work of Mr. G. C. Mitroo, our Secretary, without whose hard and devoted labour from the commencement of our work to the finish of the report it would have been very difficult to complete our assignment. Though the main report had to be drafted by one of the Members owing to technicalities involved, yet it must be acknowledged that the Secretary's help has been invaluable at the meetings, during visits of inspections, in collecting materials, providing necessary literature and references, and finally in editing and getting the Report ready for submission to the Ministry.

30. We must not forget to mention the valuable and arduous work done by the staff of the Secretariat, small as it was, particularly Mr. S. P. Mitra and Mr. Ram Sarup, who did not spare themselves in giving their devoted services.

CHAPTER II

THE PROBLEMS BEFORE US

Prevention of disease and preservation of health depend to a large extent upon the environment in which people are born, grow, school, eat, drink, travel, work and relax. This is true and valid even after making due allowances for all modern advances in methods of increasing the resistance of man to particular diseases by medical immunisation. One may use immunisation in an emergency to resist a particular outbreak of cholera, typhoid or plague, but lasting protection against these diseases can be achieved only by protected water-supply and hygienic disposal of human excreta, by ensuring that food is prepared and consumed under hygienic conditions without being contaminated by flies or carriers, and by reducing chances for rats to live in too close proximity to man. Similarly, in the control of tuberculosis, lasting

results cannot be achieved if good housing is neglected. The environment of the community has to be modified to achieve permanent control of mosquito-borne diseases. The modification of the environment on a large scale for promoting public health is the function of the public health engineer. Immunisation and provision of a hygienic environment are complementary measures in the prevention of disease and promotion of health. The benefits of immunisation are immediate and often temporary. The effects of a hygienic environment are more lasting, though perceived more slowly.

2. Apart from this aspect, the consciousness is gradually spreading among the masses in India, more particularly among industrial labourers, that a favourable environment is not merely an aid to health but a fundamental birth-right of every citizen. This consciousness will play a large part in raising the standard of living of the people from the very low level it occupies now. The assertion of the right to live in a decent environment, when co-ordinated with realisation of the duties of citizenship, will provide the urge and the means for the uplift of the people. We will, therefore, consider environmental hygiene not only from the point of view of hygiene but as a fundamental necessity of life.

3. The ingredients of a decent human environment are many.

4. The home and its surroundings should provide the family with shelter against exposure to extremes of temperature, sun, wind and rain ; with security of person and property ; with comfort ; with privacy and company of fellow beings when desired ; with aesthetic satisfaction ; and with protection against infection, contagion and physical hazards. The fulfilment of this purpose is to be achieved through town and village planning and housing.

5. People should have the facilities to obtain an adequate supply of safe, potable and pleasant water to sustain life and keep clean. This is to be achieved through water supplies.

6. They should also have the facilities to obtain adequate and nutritious food, milk and beverages, prepared and served under hygienic conditions. This is to be achieved through the sanitation of food and drink establishments, markets, slaughter houses, public eating places, dairies, etc.

7. They should live and work in a comfortable atmosphere free from hazards to their health, such as dust, smoke, odours, fumes, microbes of disease, etc. They should have adequate light, quiet and peace to carry on their duties efficiently. This is largely achieved through the control of dangerous and offensive trades and through industrial hygiene engineering.

8. The waste products of the family, the community and the factory should be collected and disposed of so as not to endanger the health of the public by any chance. This is achieved through efficient public cleansing and sewerage, through hygienic disposal of excreta and refuse, and through controlled pollution of streams, lakes, rivers, beaches, etc.

9. The risks of transmitting infection from one person to another are particularly great at places where people congregate, as at schools, fairs and festivals, places of amusement, public transport vehicles, railway stations, etc. Vigilant control has to be exercised over the sanitation of the environment in these places.

10. The environment should be unfavourable to the growth of the seeds of disease. Hence cleanliness and facilities to keep clean are important. Sunlight, dryness and other agencies discouraging microbic life should be taken advantage of with discretion. Rats, flies, fleas, ticks, sand flies and mosquitoes should find the environment unsuitable for them.

11. When a person falls ill, he should be treated in an environment favourable to rapid recovery. This will be partly achieved through the construction of hospitals, sanitoria, nursing homes, *asylum*, dispensaries, etc., designed for their particular function

12. These are our ideals. No country has succeeded in providing these to every citizen to perfection ; but every country has been striving to provide them. Progressive countries have achieved more than others.

13. India lags far behind many countries in environmental hygiene. There is hardly any sanitation in the villages where about 85% of the population lives. The village houses do offer some sort of shelter against sun and rain to dwellers, but they have no latrines, no protected water supply and no public cleansing. Men and cattle live in close proximity ; mosquitoes and flies swarm ; and rats abound in the huts and hovels. The interior of the houses is generally clean, but the surroundings are dirty. The village pond is green with algae and is constantly polluted. The river is also used for all purposes and is polluted. The soil is polluted. The village school is noisy, poorly furnished, and often devoid of urinals, latrines and drinking water. Hospitals and dispensaries are miles away, badly-built, ill-equipped and inaccessible to the sick. The village market is held on the open ground, which is sodden in rains. Public eating houses are uncommon, but an insanitary tea shop or " coffee hotel " is easily found.

14. The population in our towns has been growing fast during the last two decades. Houses are so overcrowded that even upper-middle class families have been forced to huddle in one or two rooms each and produce genteel slums. Thousands have no shelter at all and live literally in the streets in filthy surroundings. They are the dangerous elements of society-underfed, underclothed, unsheltered and unemployed or insecure about their future. The refugees have also poured into every town. They have suffered so much that it is no wonder if many of them are surly and unco-operative. Every municipality finds it difficult to supply water, remove refuse and render the usual municipal services efficiently owing to the increase of population, refugee problem and lack of resources. The public transport system has also been strained to breaking point. Buses, trams, and trains are all chokeful of hanging humanity. People lose their temper, balance and health in these trying conditions of urban life. The theatres and picture houses are full but dirty. The sanitation

of eating houses and markets is deplorable but many city dwellers have to resort to them. The cows and buffaloes in the hundreds of unauthorised cattle-sheds appear to yield little milk, but produce plenty of flies.

15. The responsibility for these unsatisfactory conditions cannot be laid only on Government or on municipalities. The people have not seriously demanded better conditions, and have not been educated to appreciate them. Even in the few health units where health departments have attempted to improve the health environment of the people by the provision of windows, latrines, etc., and by small improvements to water supply the co-ope ration and appreciation of the people have been tardy. Health units have not multiplied by voluntary demand of the people in any province, with the possible exception of the Mysore State. Whatever may be the other reasons for such sterility, the apathy of the people has certainly been a contributory factor.

16. This picture is changing, particularly in towns. Discontent with a dirty environment is growing, on account of a rapid deterioration in municipal services and in housing accommodation during the last few years. It may find violent expression unless tackled tactfully and immediately.

17. The Health Survey and Development Committee, appointed in 1944, has considered the problems under reference as part of their health plans and reduced the outline of a programme of planning for water supplies and sewerage. Its recommendations regarding the solution of acute problems of housing and town planning are rather vague. It has, however, laid down a minimum standard of accommodation for housing, which has found acceptance in the Industrial Housing Sub-Committee's report. The National Planning Committee and the Madras Provincial Housing Committee have gone into the question of costs and materials and made valuable suggestions. Even though their total estimate of costs is colosal, it is an underestimate as the rates on which it is based are much lower than current rates for building construction. The post-war plans of provinces are generally sketchy ; only Madras, Bombay, West B ngal and the United Provinces have included schemes for water supplies and drainage in their plans. Even they have produced no schemes for housing.

18. As regards implementation, it is doubtful if the Health Survey and Development Committee's plan of co-ordinated preventive and curative service will be carried out by the provinces as envisaged in its report. The plan has been pruned, metamorphosed and whittled down to nothing in many provinces. Where money had been earmarked for water supplies, it has been allowed to lapse for want of materials and man-power. The Central Government themselves appear to have put down the implementation of the Committee's plans low down in their priorities.

19. It is a matter for regret to find the Priorities Sub-Committee of the National Planning Committee stating " that the problem of finding living room and shelter for the people was not of the same urgency as that of Food or Education ". This is a conclusion with which we do not agree fully.

20. The Advisory Planning Board of the Government of India received in 1946-47 all post war planning and made recommendations as regards priorities. In their report (page 22) issued in June 1947 they dismissed Medical and

Public Health Schemes in one short paragraph having two sub-paragraphs. In the first sub-paragraph they have said : "At this stage we have no particular recommendations to make ". In the second sub-paragraph they have said: " Most Provincial Governments are at present without adequate Town Planning staff ; yet there are no plans for remedying this deficiency. There has been no estimate of the sort of staff that might be required, whether for a single city or for a whole Province, nor any proposals put forward for recruiting or training such staff. This appears to us to be a matter which requires immediate consideration ". This is also disappointing.

21. In the meantime, the recommendations of certain departmental Committees are being implemented. The Railway Board has given effect to the Mitra Committee's recommendations on housing railway employees ; and the new type houses are being built at Mihijam, Kharagpur, etc. The Coal-Mines Board are proceeding slowly with their new housing plans. The Bombay Housing Directorate is spending a few crores of rupees on housing. The Kanpur Development Board is doing the same. Rehabilitation department is proceeding with its own housing schemes. Improvement Trusts are carrying on their activities, though on a greatly reduced scale. The Ministry of Health, Government of India, has set up a Directorate of Housing for prefabs. Housing Co-operatives started under Provincial Governments' patronage are carrying on their work against great odds at a very slow pace. There was un-co-ordinated planning at a certain stage. The plans have been set aside and there is un-co-ordinated and unplanned construction going on in certain towns now.

22. The monetary conditions of India too have changed. India appears to be unable to implement even a part of the post-war plans. Having imported food out of our dollar and sterling reserves, we have reduced our resources. Food production has been accorded the highest priority, and even industries come lower. It appears as if we will forget the lessons of the past and erase the plans for water supplies, housing and other items of public health engineering when we are engrossed with our other immediate headaches of food, dollars, sterling and refugees. This would be most unfortunate in our opinion ; but it seems to be the trend of events. In the face of this depressing prospect, we have been asked to proceed with the preparation of plans for environmental hygiene.

23. We lack not only money. We lack man-power. We lack the materials of construction. This is a very serious bottleneck in the implementation of every plan. There is vague talk of, and feable attempts at, finding substitute materials. Some of these substitute materials are unobtainable in quantities and others are useless for the objects inview.

24. We have tried, in the succeeding paragraphs, to suggest technical standards in every aspect of environmental hygiene. Whatever may be the rate of implementation of our recommendations, these standards will at least be found useful in actual implementation.

25. We do not have sufficient technical personnel to carry out plans. The All-India Council for Technical Education of the Ministry of Education, Government of India, has not gone into the question of training technical

personnel for public health and public health engineering. Their recommendations for technological institutes do not include these categories. The problem of personnel and technical training for our plans has been considered in a later chapter. Here we would like to emphasize that it will be a waste of talent if the implementation of plans lags far behind training. On the other hand, it will be a waste of money if training lags far behind implementation. The two have to proceed almost together. If the demand for a particular category of worker is maintained, the supply can be kept up. Otherwise there will be slump and frustration of technical talent.

26. As we have remarked earlier, improvement in the hygiene of the environment will ultimately depend upon the demand for it by the people. If they evince no interest, nothing can be forced on them for long. The education of the public will be therefore an important factor in setting up the pace of implementation of our plans. In this respect we feel that the initial advantage lies with urban schemes. The Indian town has deteriorated badly to-day. The townsman is more educated and conscious of what he lacks and it is easier to canalise his discontent into an urge for a better environment. Urban environmental improvements may be not only more urgent but also quicker to accomplish than rural improvements. The objection may be raised that improving the towns will lead to more congestion and is unjustifiable at the expense of the rural population who are the backbone of the country. We are of opinion that congestion in towns is due not only to better amenities but also to other causes, such as quest for employment, facilities for education, etc. Decongestion of towns cannot be accomplished merely by putting off necessary improvements to the badly deteriorating towns. People will move into villages only if they have employment there and if, in addition, they find facilities for education, medical care, etc. We may create satelite towns and locate new industries outside congested towns, but we cannot postpone necessary improvements to towns whether they are new or old. We have not suggested any schemes for urban improvement at the expense of the rural population.

27. We consider that, in the rural areas, the improvement of the environment should be taken up on a slightly different pattern. Water supplies should, for instance, be taken up first. Excreta disposal and malaria control may be easy to carry out in a community, which shows interest, after some demonstrative education. Housing improvement may be more difficult to accomplish for reasons of expense, traditions, etc.

28. We have also gone into the question of organisation and agencies for carrying out our plans in another chapter (Chapter XVII). It is found that the existing organisation is unsuitable for effectively carryin go out public health engineering in some provinces. Some functions are carried out by one department and some by another. Sometimes one has to serve many masters and whoever among them is dominant becomes the effective master. Such administrative confusion is undesirable.

29. We have considered each important aspect of environmental hygiene from the above points of view and have suggested a planned programme for implementation during the short term of the next ten years and a longer term of 30 years. We have also ventured to go into the question of costs, materials personnel and finance for these projects. We would urge that the improvement of environmental hygiene should be stepped up much higher in the matter of priorities. It should be taken up simultaneously with other schemes of top priority. For, food cannot be eaten in the streets, nor washed down with polluted water. The backlog to be caught up is very great and immediate action is called for before the discontent of the people finds unpleasant expression.

CHAPTER III

HOUSING

" The existence of excessive rates of sickness and mortality in the slums or overcrowded districts or cities is an accepted fact, but the extent to which poor housing *per se* is responsible for these differences is very difficult to ascertain because of the interaction of many economic and sociological factors ". This is an observation made in the summary of findings of the National Health Survey conducted in 1935-36 by the Environmental Sanitation section of the Division of Public Health Methods, National Institute of Health, U. S. Public Health Service. It is stated by them—

(1) that the frequency of illness disabling for a week or longer is greater in crowded households ;

(2) that there is a marked increase in the incidence of pneumonia and tuberculosis with increase in overcrowding ; and

(3) that the common communicable diseases of childhood show an earlier age incidence in crowded households.

2. Housing conditions in towns in India have deteriorated very badly during the last eight years. In cities like Bombay, Delhi, Calcutta, Kanpur and Madras, it has become almost impossible even for the rich and the upper classes to secure new accommodation at any price. Families accustomed to good living huddle together in single rooms under indescribable conditions of privation and pay inflated rents to retain them. Rent Acts and controls have done little good. Relationships between landlords and tenants have been soured, and greed has debased human beings to the lével of beasts in exploiting the shortage of housing accommodation for their profit.

3. The problems of housing in our towns may be divided into two classes. The first is the absolute shortage of accommodation. This has resulted in overcrowding of even good houses beyond their maximum physical capacity and has reduced them to genteel slums. The second class of problem is the

original slum or substandard house, which should be brought up to standard, if at all possible, instead of being demolished. A substantial proportion of existing houses will fall into this class even if the abnormal overcrowding prevailing today is relieved. Such houses require careful surveys.

A. New housing required.

4. A quantitative idea of the magnitude of the absolute shortage in housing accommodation can be obtained from the report of the Madras Provincial Housing Committee. The following is a summary of their findings on this matter.

	Houses in 1941	Houses in 1946	% increase in houses	Population in 1941	Population in 1946	% increase in population
				Million	Million	
(1) Madras City ..	87,888	90,000	2·4	0·777	1·235	58·9
(2) Other municipalities in Madras (69)	460,543	552,700	20·0	3·025	4·033	33·3
(3) Major Panchayats in Madras (182).	375,000	452·000	20·5	1·880	2·322	23·5

These figures reveal the intensification of shortage as the sizes of towns grow.

5. The Madras Committee's estimates of new houses required for the province are as follows :—

(1) Madras City	165,000
(2) Madras Municipalities (69)	132,000
(3) Major Panchayat Boards (182)	33,000
Total ..	330,000

6. We can arrive at approximately the same estimate by a different approach, and incidently make a conservative estimate of the number of new houses for the larger towns of India in the following manner.

7. The growth of population in India during the last 50 years is indicated in figure below.

The curves for the whole population, urban population, population in towns of over 50,000, and population in cities of over 100,000 are all rising but some are rising at higher rate than others. They bring out the rate o fgrowth of towns. Cities of over 100,000 grew at a geometric rate of 6% per annum in the decade 1931-41 from 8·245 millions in 1931 to 14·57 millions in 1941, and their number also increased from 32 to 50 in the same period. We may assume that the shortage of houses is most acute in towns of over 50,000 and may consider them first in any plan of new housing. The number of such towns increased from 92 in 1931 to 138 in 1941 and their population increased from 12·472 millions to 20·267 millions at approximately 5% per annum geometrically.

8. The decade of 1941-51 is likely to have maintained at least the rate of urbanisation of 19431-41, if not a little more. On the basis of the same rate the following is the estimate for 1949 and 1951.

	Number			Population in millions.		
	1941	1949	1951	1941	1949	1951
Cities and towns of over 50,000 in India	88	119	128	20·267	30·15	33·38
Cities of over 100,000 in India ..	50	70	78	14·57	22·9	25·7
Municipalities of Madras ..	70	..	..	3·8	(5·268 millions in 1946).	

9. Apart from the influx of refugees, the normal urbanisation of the current decade has increased the population to such an extent that there will be a 66% increase in population to be accommodated in towns in 1951 while the increase in houses will be hardly 20%. To maintain even the standards of 1941, new houses will be needed for 46% or 9·2 million people, or about 1·84 million houses at a density of 5 per family. (Similar calculation for Madras gives an estimate of 1·94 million people to be provided with 388,000 new houses. The Madras Committee's report based on requirements in 1946 gave an estimate of 330,000 new houses).

10. Apart from this, there are the refugees numbering about six millions who will require a minimum of one million houses.

11. An estimate of the cost of 2·84 million new houses (1·84 million for normal urbanisation and 1 million for refugees) will be a colossal sum, but there is no need for putting forward such a figure. It is quite clear that no Government can afford to undertake any large fraction of it as a single enterprise. These houses will have to be built largely by non-Government enterprise, and to some extent by Government, who should also give indirect assistance to get houses built quickly by various agencies.

B. Building materials, methods and costs.

12. The obstacles to the construction of new houses are many. The cost of living has increased to about 385% of the 1939 level, and labour costs have

also increased almost to the same extent. The income of the salaried classes has not increased to more than about 200%. Hence the middle classes in towns, who might have tried to build their own decent houses, have been so hard hit that they cannot dream of owning a house. Land has soared up in value. Building materials are so scarce that only a brave man can persist in trying to build a house. Bricks, wood, cement, steel, pipes, fittings are all unobtainable. The least that Government can do is to allocate a substantial proportion of the production of these materials in the country for house building. Government has a large number of projects in hand and takes away the biggest share of production of these materials. Launching on these projects after stifling all private housing activities during the war years, Government is aggravating the shortage of building materials and their transport and thereby raising the cost of construction.

13. It goes on in a vicious circle and reacts on Government projects. As the immediate arrears to be covered in housing are at least 2·84 million houses (which will represent an investment of at least 600 to 900 crores of rupees by various parties, while the total cost of Central and Provincial five-year plans for productive schemes has been estimated to be only 546 crores, (*vide* page 66 of the report of the Advisory Planning Board), we would urge that at least a quarter of the steel production, cement production, coal, transport, etc., be allocated for house building in the country and, that, at the same time, steps be taken to increase the production of steel, cement, lime, bricks, etc. Otherwise the shortage in housing cannot be relieved.

14. There are a few housing schemes going on in the country today. The Rehabilitation Ministries and Railways are building houses. Houses are under construction for the priority projects of Government, such as the fertiliser factory and multipurpose projects. The Kanpur Development Board has recently built a large number of houses, chiefly for refugees. The house building programme in the coal-mines has slowed down. The Bombay Housing Board has built a number of houses for a few crores of rupees and is building more. All these are Government projects getting their allocation of building materials under some priority. The Bangalore Improvement Trust has built a fairly large number of houses in a short time. Though enjoying some preference over private enterprise for allocation of building materials, Building Co-operative Societies in various places have been able to build only slowly owing to the lack of materials, and their costs have risen. Even large industrial concerns like Tatas have had to slow down or even stop the construction of quarters for want of building materials.

15. The cost of building construction has risen to Rs. 8 to Rs. 15 per square foot of plinth area in most places. Alternatives are sought for conventional methods of construction in many places. The materials used will naturally vary in different parts of the country. It would be imprudent to generalise that any one material would be cheaper than another. Although in most places concrete is cheaper than wood, wood seems to be available and fairly cheap in Assam, the Central Provinces and Orissa. Similarly, lime may be cheaper than cement in many provinces, but it is not so in and around Calcutta.

16. We have noticed that, in the eagerness for reducing the cost of construction, public authorities and Governments go in for mud walls, bamboo

matting and thatched roof for houses. We wish to point out that, however comfortable these may be, their initial cost is at least one-fourth to one-fifth of the conventional brick house with tiled or terraced or concrete roof. The cheap house lasts two to five years with constant repairs and ravages of rats and white ants, while the conventional house lasts at least thirty years with minor repairs. The cheap house is dearer in the long run, and is unjustifiable when built out of public funds. It is only suitable under the fond care and maintenance of the rural owner. We wish to sound this note of warning as we understand that such cheap public buildings and houses are to be built in some provinces.

17. An analysis of the cost of building of the conventional house, based on the actual experience and estimates of some of us, is given below :—

Analysis of building costs.

(1) The plinth area is usually 12% to 20% more than the floor area or carpet area. The smaller the house or the room, the greater is this proportion, but on an average about 16% more may be reckoned on.

(2) The following is a rough allocation of the minimum materials and average cost of the various parts of a conventional building using the minimum of steel and cement.

	%
Walling or shell	25·0
Doors and Windows	15·0
Flooring	4·0
Roofing	17·0
Plastering and finishing ..	22·0
Overheads, supervision, and profits excluding those on piece work	17·0
Total ..	100·0

	%
Bricks, stone, etc.	18·5
Lime 6·8%s } Cement 4·2% }	11·0
Sand	4·0
Wood for doors and windows ..	9·0
Door and window fittings ..	1·5
Iron and steel	1·5 to 6·5
Tiles or other roofing materials ..	5 to 0
Labour, *i.e.* Carpentry 6·8% } Brick layer or mason 12·3% } Unskilled labour 8·2% }	27·3
Overheads, supervision and profits including those on piece work	22·2
Total ..	100·0

(3) Compared to prewar rates, present-day costs work out as follows for certain classes of work, *e.g.*,

(*a*) Brick work, about 350 to 400%.

(*b*) Doors and windowns, about 200% to 300%.

(*c*) Steel, about 300% controlled, and 500% in the black market—very scarce.

(*d*) Cement, about 200% controlled and 300% in the black market—(Rs. 125 or more per ton).

(*e*) Concrete, about 300%.

(*f*) Reinforced concrete, about 200 to 225%.

(*g*) Plastering and finishing, about 500%.

(4) Vertical development involves the use of less land but a little more cement and steel, and a little more expense on account of a staircase. If the cost per square foot of floor area on singlestorey development (excluding land and amenities) is taken as 100, the cost for three stories will be approximately 111 on the same basis per floor. The ground floor walls and foundations will be stronger. The cost will be approximately 120 on the ground floor, 107 on the middle floor and 107 on the top floor.

(5) The saving effected by having a common wall in semi-detached buildings is 7 to 10% in the total cost of a detached building.

(6) In attached construction, the saving effected by building a number of houses together is about 12½% for four or five houses together.

18. The above analysis will be helpful in discussing ways and means of effecting economies in building costs. Nearly 22% of the cost goes in for overheads. About 6% may be incurred on supervision and 10% on financing and profits, but at least 6% can be saved by rationalisation in the building industry, by organising mass production and by cutting down profits and leakage at every stage. Nearly 15% of the cost of a building is covered by doors and windows of the conventional type, with thick frames, which cut out light. Standardisation of doors and windows and mass production will effect a reduction in cost. Further, the substitution of steel and concrete for wood in the door frames can effect economies in all localities except those, where timber is produced cheap. We have noticed that the use of cement windows for cheaper-class houses has already come into vogue, and we believe it has come to stay. With suitable design, the redundancy of a lintel over an already strong top rail on a window or door frame may be eliminated. The hinges to hang shutters on a concrete door or window frame are not satisfactory yet, but these can also be evolved and standardised.

19. An item on which alternatives are being tried is the walling or shell of the house. A saving in cost can be effected by the use of stabilised soil as at Bangalore. A machine may be used to turn out blocks. However, a house built of stabilised soil will require about 18 cubic feet more of cement per 100 square foot of floor area than one of brick-in-lime, as the soil has to be stabilised with 5% cement. As cement is also required for other works (such as dams, bridges and roads) and is in short supply, it is doubtful whether it can be made available in quantities for any large-scale housing with stabilised soil. We have also seen rammed-earth construction which seems to be fairly satisfactory. We cannot say how well it will stand the monsoon. "Wattle and daub" or bamboo-plastered over with mud, etc., is successful and popular in Assam. In other provinces this type of construction may not succeed owing to white ants. We have also seen housing with precast concrete panels. Double 2½-inch panels with a thin air space on the exterior walls and single panels for interior walls should render the house cool and eliminate the need for plastering, etc. Hollow concrete blocks too have this advantage and are being used. Concrete poured *in situ* has been tried, but not on any large scale.

20. We have also read about the rapid construction of houses by "guniting" light bamboo walls with cement.

21. If the extra cement involved in the case of concrete for walls is readily available and if concrete is designed so as to give the thermal insulation and other benefits of a brick house, there is no objection to it and in fact it may cut down labour costs and facilitate faster construction. It may also produce savings in foundations. However, such a house requires at least 22 cubic feet of cement per 100 square feet of floor space. The possibilities of using this alternative for economy and quickness hinges on the production and allocation of cement.

22. We do not favour the use of corrugated iron sheets or asbestos sheets for outer walls unless a proper insulating material is also provided.

23. We have an open mind with regard to the use of bamboos as a reinforcing material. This is untried, there are no canons of design and, in the present state of our knowledge, it should not be used on spans of over four feet without further research and experience.

24. We have no experience of prefabricated houses of aluminium in India. They may be comfortable but we do not produce sufficient aluminium. It may turn out that such prefabs are more expensive than the conventional brick houses. As for prefabs of wood, the basic material wood is difficult to get in most provinces, and climatic conditions and termites will make them unsatisfactory.

25. There may be various agencies for building new houses for our needs. It is essential that they should conform to certain minimum standards. We have considered these standards at a later stage. It is essential to define these standards objectively and enact them as far as possible, and set up an agency for administering the legal provisions. All new housing should be regulated by these standards.

26. The development of new housing projects involving more than 20 houses should be promoted only on the basis of proper planning which we have considered in another chapter (Chapter IV). The best way would be to try to plan and develop "satellite towns" and "neighbourhood units", to promote self-sufficiency and mixing-up of social groups for housing populations of 10,000 to 20,000, instead of adding on the fringes of existing towns. Whether the development should be vertical or horizontal will depend on the relative costs of land and building. We think greater consideration should be given to the economical use of land than has been done in the past, as land is scarce in the towns where the new houses will be mostly needed.

C. Standards of healthful housing

27. All new houses should be built, and existing houses should be surveyed, examined and improved to conform to the standards of a healthy house. It is therefore necessary to indicate these standards a little more distinctly than they appear now, even though a precise definition is difficult for various reasons. They should be accepted by the nation or the State. The more precise application within a range representing the optimum and the minimum should be left to Provincial Governments and local authorities. That should be covered by legislation, bye-laws and schedules to suit the peculiar local conditions of climate, materials, social customs, etc., that may obtain.

28. We have no legislation at provincial level on the standards of healthful housing. We have building bye-laws and regulations applicable in certain municipal areas ; these mostly concern heights of plinth, heights of buildings in relation to adjoining roads and open spaces, sizes of courtyards, window and floor spaces, strength of floors, thickness of walls, etc., in certain cases. They show great diversity.

29. The basic principles of a healthful house have been formulated by the Committee on the hygiene of housing of the American Public Health Association and are of general application. A house should be normally designed for family life and should satisfy :—

(1) the fundamental physiological needs of man, *viz.*, a thermal environment which will not cause discomfort, adequate and safe air supply, adequate and suitable daylight and artificial light, protection against excessive noise, and adequate open space for exercise and play of children ;

(2) the fundamental psychological needs of privacy, family life, community life, avoidance of fatigue in household tasks, cleanliness, aesthetic satisfaction in the house and its surroundings, and concordance with prevailing social standards in the local community ;

(3) the fundamental health needs of a safe and adequate water supply, facilities for preparation and storage of food, milk, etc. ; facilities for excretion without risk to personal or public health, freedom from opportunities for harbouring vermin, insect vectors of disease, rodents, etc. ; and sufficient space to prevent infection and contagion among the residents ; and

(4) protection against accidents due to fire, electricity, gas and traffic and against mechanical injury.

30. The target standards of a ' fit house ' recommended by the Central Advisory Committee of the Ministry of Health (U.K.) are :—

(1) It should be in all respects dry.

(2) It should be in a good state of repair.

(3) It should have each room properly lighted and ventilated.

(4) It should have an adequate supply of wholesome water laid on for all purposes inside the dwelling.

(5) It should be provided with efficient and adequate means of supplying hot water for domestic purposes.

(6) It should have an internal, or otherwise readily accessible, water closet.

(7) It should have a fixed bath, preferably in a separate room.

(8) It should be provided with a sink or sinks and with suitable arrangements for disposal of waste water.

(9) It should be provided with facilities for domestic washing, including a copper, preferably in a separate room.

(10) It should have a proper drainage system.

(11) It should be provided with adequate points for artificial lighting in each room.

(12) It should be provided with adequate facilities for heating each habitable room.

(13) It should have satisfactory facilities for preparing and cooking food.

(14) It should have a well-ventilated larder or food store.

(15) It should have proper provision for the storage of fuel.

(16) It should have a satisfactory surfaced path to out-buildings and convenient access from a street to the back door.

It will be noticed that some of the above items cannot find universal application in India. Items 5 and 12 are instances. There are others.

31. The standards recommended by other Committees which have considered the subject are summarised in Appendix IV. A house means a residential house, flat or tenement and should ordinarily be designed for family life. The exceptions are hotels, hospitals, hostels, dormitories, etc., which will conform to standards slightly varying from general standards recommended below as the optima for housing :

(1) The site should have an independent access to a street of adequate width and should be in pleasing surroundings free from hazards of flooding, land slides, fly breeding, mosquito breeding, nuisances, dust, smoke, smells and excessive noise. The soil should be dry and safe for founding the structure.

(2) The set-back of the house from the road and the surrounding houses should be such as to make lighting and ventilation through windows effective without obstruction of light or air. (The proportion of built-up area to site may not exceed 1 : 3 in the smaller municipalities and fringes of big cities where the density thins out, but may be 2 : 3 in the areas of high land values.)

(3) Each dwelling house should have an independent access with sufficient privacy.

(4) The floor of the house should be easy to wash and to keep clean and reasonably dry. Concrete or other impermeable rat-proof and smooth floors are desirable and should be the mimima in certain situations, such as houses in areas of endemic plague or houses let to labourers, etc. The height of the plinth and damp-proofing measures should be of an approved standard.

(5) The exterior walls of the house should have a heat transmittance co-efficient ' U ' of not more than 0-20 British Thermal units per square foot per hour per 1° F difference of temperature as an optimum. The minimum should be 0-35 British Thermal units per square foot per hour per 1°F difference of temperature. The sound insulation value of external walls should be preferably 55 decibels and that of internal walls 35 to 45 decibels. The walls should have a low heat capacity. They should be smooth, easy to keep clean,

weather resistant, unsuitable for harbourage of rats or vermin, not easily damaged, and reasonably strong against impact. They should be finished in a colour that will not absorb more than 35% of light. They should be raised sufficiently to ensure privacy. (The above standards can be attained by a nine-inch " brick-wall " plastered smooth and coloured cream or white).

(6) The roof of the house should have a heat transmittance co-efficient U of not more than 0·30, and in the warmer regions the height of the roof should be not less than 10 feet in the absence of air-conditioning for comfort.

(7) The number of living rooms should be not less than two, at least one of which can be closed for security. The other may be open on one side if that side is a private courtyard. The number and area of rooms should be increased according to the size of the family, so that the recommended floor space per person may be made available.

(8) The floor area of living a room should be at least 120 square feet for occupacy by more than one person and at least 100 square feet for occupancy by a single person. The floor area available in living rooms per person should be not less than 50 square feet ; 100 square feet is recommended as the optimum.

(9) Unless means are provided for mechanical replacement of air, the height of rooms should be such as to give an air space of at least 500 cubic feet per capita, preferably 1,000 cubic feet.

(10) Unless mechanical ventilation and artificial lighting are provided, every living room should be provided with at least two windows and at least one of them should open directly or through an unobstructed verandah on to open spaces belonging exclusively to the house or to the public or to assured open spaces. The windows should be placed at a height not exceeding three feet above ground in living rooms and should have such an area that the daylight factor in the room exceeds 1% over half the floor area.

(11) The windows and doors should be so located as to ensure privacy at will. The shutters in external doors and windows should be able to cut out heat and glare when closed, and to cool the room rapidly when opened out.

(12) The house should have sufficient and suitable artificial lighting in each part for domestic purposes to supplement natural daylight.

(13) The house should have a kitchen protected against dust and smoke ; adequately lighted by windows ; provided with arrangements for storing food, fuel and provisions ; and provided with water supply, a sink for washing utensils and arrangements for draining.

(14) The house should have a safe and adequate water supply.

(15) The house should have a latrine of an approved sanitary type belonging exclusively to it and readily accessible from it.

(16) The house should have approved facilities for removal and disposal of solid and liquid wastes.

(17) The house should have facilities for bathing and washing, preferably belonging exclusively to and readily accessible from it and ensuring privacy.

(18) In districts where winter temperatures are likely to fall below 50°F for more than a week, the house should have approved facilities for heating.

(19) In districts where summer temperatures are likely to rise above 105°F, the house should contain an enclosed courtyard, open space or terrace of sufficient area for the inmates to sleep in comfort at night.

(20) The house should be designed in an approved manner for the occupation, if any, that may be carried on there for profit such as dairying poultry farming, smithy, carpentry or other cottage industries.

(21) The materials and construction of the house should conform to approved standards of plumbing, structural strength, fire protection and electrical and gas installation.

32. The above standards should be the basis of a National Housing Code and should govern all housing. The code should give room to the local authorities to define appropriate minimum standards more precisely and to suspend or modify any rule where strict enforcement is impracticable. We think these rules should be applied in their entirety in all urban areas and industrial labour colonies. Suitable legislation should be undertaken to incorporate these rules in the Municipalities and Panchayat Acts and to set up the administrative machinery for ensuring compliance with rules before and after building of or alteration to houses.

33. In rural areas the " approved " standards may be lower than in towns. The minimum should be a two-roomed house on a dry site with separate access, giving sufficient security. It should be provided with a separate kitchen with a paved sink or platform for washing utensils and a sanitary latrine ; effective windows equal in area to at least 10% of the floor space ; a well, tube-well or tap for water supply within quarter of a mile from the house ; open space in front, within or behind not less than twice the built-up area ; separate and adequate accommodation for the animals and implements associated with rural occupations ; a manure pit ; and arrangements for safe disposal of waste water.

34. Although we find a general rise in the minimum accommodation standards of new houses that are going up now, we have also noticed a tendency to reduce essentials in some cases. The water supply and latrines have been omitted in some Government projects that have been completed. These are

indispensable elements in the practical maintenance of standards of decent living ; any one who lets a house to a family for occupation without these facilities should be punished by law. A single living room and a very small kitchen are referred to in some housing projects as two rooms. We would urge earnestly that a house should be built as a two-roomed structure apart from the kitchen, the bath, etc., up to standard, even if exigencies require that it should be occupied by two families till the shortage is relieved. If it is built as a one-roomed structure with a kitchen, it will lead to occupation of the single room by more than one family under stress of circumstances, with deterioration of health and social and moral values. It will be very difficult to add a room to a single-roomed house, unless the single room is large enough to be divided into two. We have in mind the so-called double-roomed tenements that are being built in Bombay by the Housing Commissioner under the Bombay Government's Industrial Housing Scheme (vide India, 31st August, 1947) which we have inspected. These are good looking but they perpetuate the evils of the one-roomed tenement while calling it a double-roomed one. If a single-roomed house is absolutely unavoidable, it should have a floor space in the living rooms of at least 200 square feet in our opinion, and there should be a separate kitchen of at least 50 square feet.

35. We would also stress that research should be undertaken in institutions of technology and engineering to evolve new designs, materials and methods of construction with a view to promoting better fulfilment of the basic principles of healthful housing at lower costs. The studies promoted by the American Public Health Association and by the Directorate of Post-War Building in England are commendable. The Department of Scientific and Industrial Research in England has a building research board which has carried out valuable research in this field and has published a series of books. The Board of Scientific and Industrial Research in India has also established a laboratory for building research, but it should be fostered to grow into full stature, not merely as a " building research " station but as a " housing research " station, engaged in problems of health, comfort, illumination, ventilation, insulation, accoustics, plumbing, furnishing, finishing, etc. For this purpose, there should be a closer collaboration between the research workers in that laboratory and leading workers in public health and public health engineering.

D. Positive Plans for new housing

36. We have indicated earlier the number of new houses that will have to be built within five years to reduce the congestion in towns of over 50,000 to the level that prevailed in 1941 and to accommodate refugees. The two requirements are roughly in the proportion 65 : 35. Both are urgent. The stresses of war and partition have been so heavy that we should congratulate ourselves if we can attain the 1941 standards by planned effort within five years. To achieve this we should plan to build at the rate of about 560,000 houses a year for the next five years. This may be spread in the following manner over the various provinces, giving due weightage to the normal needs and the extent of the regfugee problem in each province.

Province.	Needs weighted for refugees problem		Target for new houses per annum for first five years	Target of new houses per annum for subsequent 10 years in industries, cities and municipalities.	Normal needs.
	%				%
West Bengal	21	or	118,000	76,000	18·0
Madras	11	or	61,500	69,000	16·5
Bombay	14	or	78,400	71,000	17·0
Assam	1·5	or	8,400	8,400	2·0
Orissa	1	or	5,500	4,200	1·0
Central Provinces & Berar ..	4	or	22,400	16,800	4·0
Bihar	4·5	or	25,200	12,800	3·0
United Provinces	16·0	or	89,500	76,000	18·3
Delhi	5	or	28,000	16,800	4·0
East Punjab	11	or	61,500	21,000	5·0
Mysore State	3·5	or	19,600	16,000	3·8
Hyderabad State	3·5	or	19,600	16,000	3·8
Other States	4·0	or	22,400	18,000	3·9
	100·0		560,000	420,000	100·0

Note.—The weightage for refugees has been calculated on the basis of six millions, distributed as follows :—

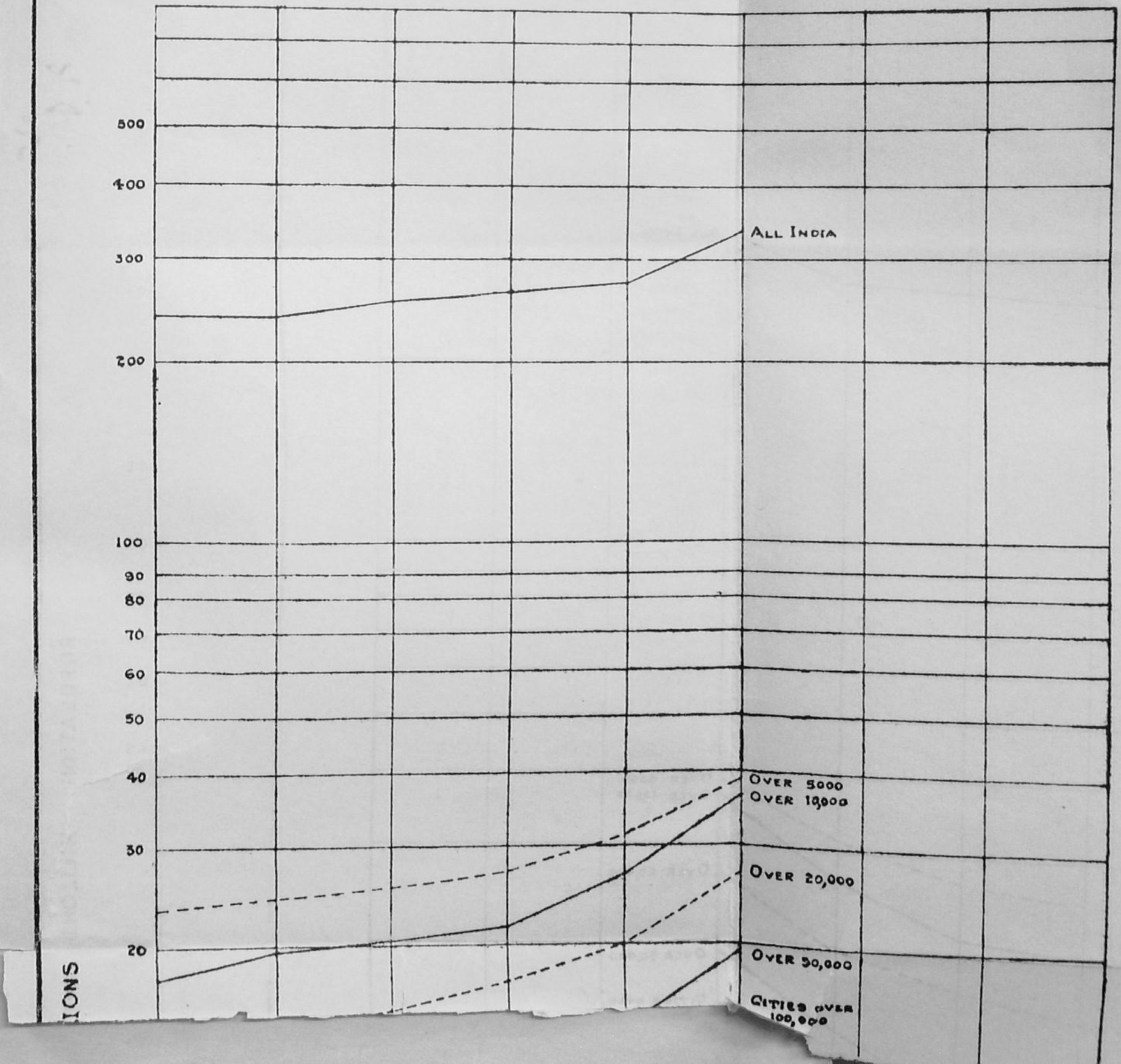
	millions
West Bengal	1·60
Delhi	0·40
Madras	0·05
East Punjab	1·40
Bombay	0·50
Assam	0·03
Orissa	0·06
Central Provinces and Berar	0·25
Bihar	0·45
United Provinces	0·75
Mysore State	0·13
Hyderabad State	0·13
Other States	0.25
Total ..	6·00

37. After the first five years, the total rate of new house construction may be reduced to about 75% of this rate for the next 15 years and spread as indicated under normal needs so that we may be able to cater for urban aggregation and undertake demolition of slums and houses that may be too bad for mprovement.

38. It will be noted that the needs of West Bengal and East Punjab are very great, while their resources have been reduced. This construction programme cannot be undertaken by the Central Government or Provincial Gov-

GROWTH OF POPULATION
IN
INDIAN DOMINION

1891 - 1941



GROWTH OF POPULATION IN INDIAN DOMINION

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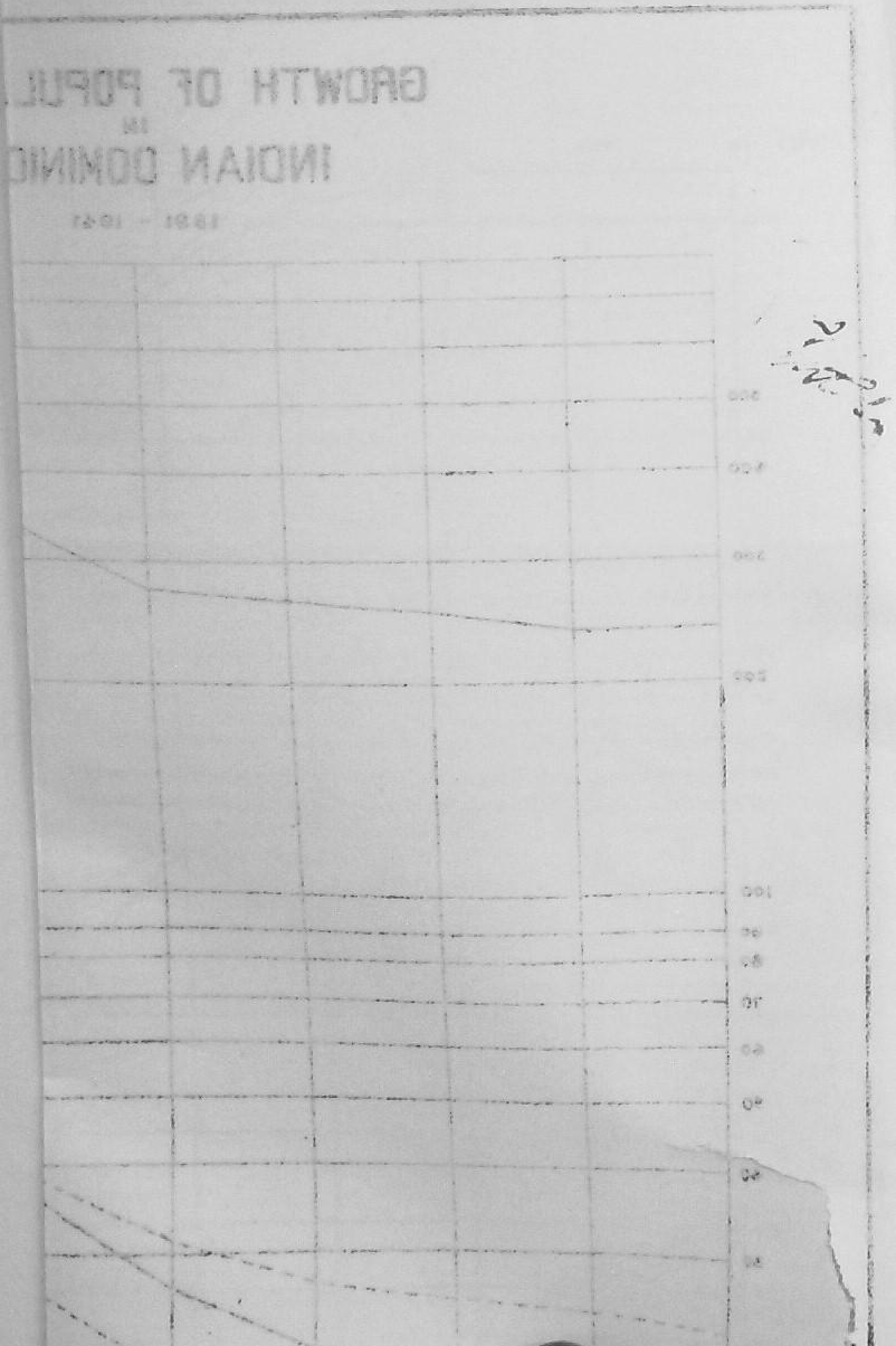

ernments or indeed by any one single agency, for 560,000 houses per annum represent an expenditure of Rs. 1,680 to Rs. 2,800 millions. Even the refugee housing, amounting as it does to 35% of the cost, cannot be undertaken by Government alone.

39. The bulk of this new housing, probably 90%, will be for the poor and the lower-middle class. It has been pointed by many authorities and committees that the housing of the poor cannot be a financial success as they cannot pay an economic rent and that it should, therefore, be a public utility. We agree with these views, but the mere reiteration of these views cannot solve the problem. We wish therefore to suggest measures that will make the solution practicable. It is often said that a minimum standard house will cost at least Rs. 3,000/- to Rs. 5,000/-. The rent that a family can afford if assessed at 5% to 10% of its income, of Rs. 60/- to Rs. 70/- a month, will be only Rs. 3/- to Rs. 7/- per month, and this will not represent more than 1·2 to 1·7% return on investment. It will not cover even maintenance not to speak of taxes. Hence it is said that Government should build the houses and let them at subsidised rents and meet deficits. On this line of reasoning Government will have to do everything—find the capital, build an provide a fund for depreciation. As Government has not got such large capital to spare for unproductive projects and as deficits can be met only by taxation of the people (75% or 80% of whom cannot even pay an economic rent), the main problem of housing has remained untouched by the industrialists, the capitalists and Government.

40. With the acceptance of housing as a public utility, it implies that the State can, and should, intervene to the extent of—

(*a*) preventing excessive exploitation of the public for private profit, and

(*b*) ensuring that the service rendered is covered by adequate payment.

This is the most appropriate policy for Government to adopt in order to promote this service. To conserve capital for other immediate necessities and projects, Government should encourage private capital to flow into the housing business and ensure an adequate return but should, at the same time, control excessive profit. Excessive profit is generally made on housing enterprise for the middle classes. Just as Government has fostered in the past the establishment and growth of railway companies by acquisition of land, part investment of capital, prescription of standards, and limitation of rates of fares, etc., and just as it has promoted the growth of electricity distributors by licences, control of tariff etc., in the same manner Government can solve the major part of the housing problem by encouraging public companies to be formed and by ensuring that they will get a fair return on investment. It is only fair and reasonable that the person who derives a benefit should pay for it.

41. The idea that only 5% or 10% of one's income should be spent on house rent is not based on reasons, but probably on the fact that Government has been recovering rent at 10% of pay for quarters provided by it. The majority of people are not in Government service and have to pay full value for the accommodation. In other countries, house rent represents 15% to 20% of the family expenses. In America, it was observed from a housing survey by the Memphis Department of Health that " the rent-income ratio lay between 22%

and 25% in all cases " (*vide* Housing for Health—papers presented under the auspices of the Committee on Hygiene of Housing of the American Public Health Association, page 27). We also should be prepared to go up to 15% at least. If that conception means a revision of wages, our answer is that Government and many enlightened employers are already paying a house-rent allowance which, when added to the 10% of the basic pay, brings the recognised standard of legitimate expenditure on housing to levels of 15% to 25%. Why then should we make a mental reservation and think of 5% or 10% only as the legitimate expenditure on house rent ? All people except the rich find that house rent in towns forms more than 15% of the total family expenditure.

42. If a housing scheme for a sattelite town or neighbourhood unit of, say, 2,000 houses family units is planned, the land required may be 100 to 120 acres. We have emphasised in a subsequent chapter (Chapter IV) the need for planning before undertaking any housing scheme involving more than 20 houses and for regulating all planning by private, public or other authorities to fit into a master plan. Government may acquire land in blocks of 15 to 120 acres for such housing projects and lease them to public housing corporations on the following conditions :—

(*a*) The land shall belong to Government and shall be leased to the Corporation at not more than Rs. 300/- to Rs. 900/- per acre per annum for 60 years.

(*b*) After securing the approval of the appointed authority, the Corporation shall develop the land, put up roads, water supply ; lighting, sewers, drains, etc., and, within a year, shall commence construction of houses of the following categories in the proportion shown against each and shall let them out at rentals on the basis approved by Government for each category :—

(*i*) Class C houses for the poor	70% approximately
(*ii*) Class B houses for the lower middle class	20% approximately
(*iii*) Class A houses for the upper middle class	5% approximately
(*iv*) Shops and markets	5% approximately

(*c*) The Corporation shall pay the taxes to the municipality, where necessary, on the rental value fixed by Government and shall maintain all buildings in good repair. A schedule of essential maintenance requirements shall be fixed. If there is no municipality, 20% of the rents shall be earmarked and spent for municipal services to be rendered by the Housing Corporation or any other approved agency.

(*d*) After 30 years, Government shall have the option of either taking the estate over, after paying compensation for the buildings, or renewing the license for 10 years.

(*e*) No housing Corporation shall be permitted to operate if it does not succeed in putting up at least 25% of the stipulated number of houses in five years.

(*f*) Government shall arrange for allocation of steel, cement, pipes, and other articles on the highest priorities to such projects and facilitate rail and road transport.

(*g*) The Corporation shall secure the services of a town planner for planning and shall get its designs approved by the Ministry of Health of the province.

43. A scheme incorporating a judicious mixture of A, B and C class houses and shops and markets roughly in the proportions given above will be a financial success and can be made a public utility. The financial implications of a scheme for 2,000 houses (family units) will work out as follows.

I. *Capital investment.*

	Rs.
70% of the buildings as houses for the poor (class C), floor area 300 to 600 square feet (average 450 square feet) each :	
Cost of 1400 such houses @ Rs. 9/- per square foot (or, on an average, Rs. 4,050 per house)	5,670,000
20% of the buildings as houses for the lower-middle class (class B), floor area 900 to 1200 square feet (average 1,050 square feet) each :	
Cost of 400 such houses @ Rs. 11/- per square foot (or, on an average, Rs. 11,550 per house)	4,620,000
5% of the buildings as houses for the upper-middle class (class A), floor area 1,500 to 2,500 square feet (average 2,000) square feet) each :	
Cost of 100 such houses @ Rs. 14/- per square foot (or, on an average, Rs. 28,000 per house)	2,800,000
5% of the buildings as shops and markets, floor area 500 square feet : Cost of 100 such shops and markets @ Rs. 15/- per square foot or Rs. 7,500 per shop	750,000
Roads, water supply, lighting, health centre, school, play-ground and other "free" amenities	1,000,000
Total ..	14,840,000

II. *Gross return per annum.*

	Rs. p.a.
Rent for 1400 class C houses @ Rs. 4/- per 100 square feet of floor space (or, on an average Rs. 18/- per house) per mensem *OR* ..	302,400
Rent for 400 class B houses @ Rs. 6/8/- per 100 square feet of floor space (or, on an average, Rs. 68/4/- per house) per mensem *OR*	327,600
Rent for 100 class A houses @ Rs. 9/- per 100 square feet of floor space (or, on an average, Rs. 180/- per house) per mensem *OR*	216,000
Rent for 100 shops/markets @ Rs. 16/- per 100 square feet of floor space or Rs. 80/- per shop per mensem .. *OR*	96,000
Total rent ..	942,000
Less ground rent payable in respect of land—110 acres (mean of 100 and 120 acres) @ Rs. 600/-) per acre per annum	66,000
Gross return ..	876,000

This will give a gross return of 5·9% and (after allowing for 20% of the assessed rent for municipal services or rates and for 1% of the capital cost towards sinking fund, repairs, collection charges, etc.) a net return of 3·6%. If the cost of building construction is reduced, a higher net return may be expected. The tariff regarding rents can be varied in relation to building costs.

44. The method outlined above is slightly different from the working of improvement Trusts. In Improvement Trusts, the land alone is developed and then either sold or leased. Individuals put up their own houses. There is no control on the rent and the public utility aspect of housing is defeated. The house can be sold and, every time it is sold, the property appreciates in value. The cost of land is heavy. It constitutes a large element in building a house in a town, and has to be borne outright by the trust. Speculation takes place ; because the land is parcelled out and private individuals can compete. In our scheme, Government acquires a plot of land sufficiently large and unfit for food production, if possible a little away from a town, at a comparatively cheap price, or it may allot its own land. It leases out large blocks not at competitive rates but at rates within certain limits (enough to give a 5% return on the gross value of the land), and gives scope to capital raised by public subscription or belonging to insurance companies, etc., to develop the land to approved standards and let them out at controlled rents based on a fair return on capital and area of accommodation. The company has to build a mixture of houses, for the poor, the middle classes and the rich, without being burdened with the cost of the land, and so gets an adequate and balanced return. The community forms a balanced mixed neighbourhood. Municipalities need not sacrifice their rates for services they may render. Large-scale building will put the building construction also on a more efficient and economic basis, and will give advantage to a wholesale consumer and will reduce overheads and profits at intermediate stages.

45. We are of opinion that such a mixed community as will develop under the above plan will tend to wear off the angularities due to segregation of classes.

46. In a satellite town of the above type, there may be room for one to four corporations to operate. Each should plan to build at least 125 to 500 houses in a year on 30 acres of land, and will need a share capital of rupees 7 to 30 lakhs. The full ground rent for the site may be waived by Government for the first three years. The cost to Government will be only in respect of the acquisition of land for the project. There is scope for about 1,000 to 2,000 such housing corporations in India to be run as public utility concerns.

47. A considerable amount of housing can be done by small private enterprise also if building materials are made easily available. However, the cost of land will figure largely in such housing, and the benefits will not reach the poor classes, as they will not be able to pay economic rents even at 15% of their income.

E. Housing of Government and Municipal employees

48. The Madras Provincial Housing Committee has recommended that Government servants in Madras should be provided with Government quarters, at least to take them away from competition with the public in the scramble

for accommodation. Further, it is the role of Government to set the example and provide accommodation to its employees as far as possible. If Government servants of all classes are provided with accommodation, the saving in house-rent allowances would justify the capital expenditure. However, there is another point to be considered. Except in a few towns, Government can make better use of its capital by utilising it for acquiring land, instead of spending it on buildings, and we are therefore not in favour of such a project everywhere though, financially, the construction of quarters for Government servants on a mixed basis would be remunerative.

49. In big cities like Bombay, Calcutta, Madras, Delhi, Nagpur, etc., the position is different. In these places where Government servants found it difficult to secure accommodation during the war, even the high-paid officials were given fat house-rent allowances enabling them to spend up to 20% of their pay on rent. In the midst of acute shortage of housing, they naturally raised the prevailing rents in towns when they got these privileges, and stimulated the greed of landlords. The Rent Acts were introduced, but have not succeeded in making either the landlords or the tenants happy. The landlords have adopted all nefarious means within the letter of the law to have a change of tenancy, raise rents, and collect " salami " or premia illegally. There are tenants who have also stubbornly refused to recognise the conditions of inflation and to offer reasonable increases in rent. The result has been an utter demoralisation of the relationship between landlord and tenant, and lowering of the hygiene of housing.

50. Government has built too few houses for its employees, particularly in these big cities. It has a Government estates department which is supposed to find accommodation for government employees. Actually the working of this department has not given satisfaction to any one. Officers dread transfers to these places as they will be without accommodation for a few years. The estates department does not requisition additional houses for new officers, does not build and does not offer any efficient protection to a Government servant who is in trouble with his landlord. Its main business is negation. We consider that either this department should be given powers and charged with the duty of finding accommodation for all Government employees within 3 months of their asking for it, or it should be abolished.

51. In big cities like Calcutta, Bombay, Delhi and Madras, we consider that Government should provide quarters for at least 60% of their employees. At presently there is no accommodation even for 5% excepting in New Delhi.

52. There is a great disparity in the accommodation provided for different classes of Government servants. The railways have been most liberal, almost lavish, in the past in providing accommodation for superior staff. They have also borne indirectly some of the charges for amenities and services in municipal areas. In future, we would suggest the following scale of accommodation in housing, conforming to the standards of healthful housing, for all Government employees :—

A class—Floor space including garages and outhouses, if any 1,500 to 2,500 square feet.

Rent Rs. 135/- to Rs. 225/- per month for unfurnished accommodation.

B Class—Floor space 900 to 1,200 square feet.

Rent Rs. 58/8/- to Rs. 78/- per month for unfurnished accommodation.

C1 class—Floor space 450 to 750 square feet.

Rent Rs. 18/- to Rs. 30/- p.m. for unfurnished accommodation.

C2 class—Floor space 200 to 450 square feet.

Rent Rs. 8/- to Rs. 18/- p.m. for unfurnished accommodation.

53. Charging for accommodation on the basis of area will put the Government servant on par with the public in getting the advantages of a public utility.

54. Government should also provide accommodation for their employees in small towns of less than 10,000. In such places it will be extremely difficult to find suitable rented accommodation.

55. Government should provide accommodation for all employees in all essential services—such as railways, posts and telegraphs, police, and health. Hospital employees waterworks employees, sewerage and sewage disposal employees and electrical supply operators, whose services may be required at all times, and municipal sweepers should be provided with accommodation.

F. Housing of Industrial Labour

56. The housing of industrial labour has been treated as a special problem and has been considered by many Committees, beginning from the Whitley Commission. It is no doubt special in the sense that such labourers are generally poor and that their conditions of living are satisfactory only in exceptional cases. Their contentment and efficiency should be ensured from the point of view of public health and industrial production. Their aggregation in towns and overcrowding in huts, etc., aggravates the slum problem. It would not be far from the truth to say that industrial labourers form the nucleus around whom slums grow in many towns.

57. In plantations, the labourers have been housed in some way. The plantations will have to close down unless the labourers is given the inducement of a house to live in. Only a small percentage of miners have been housed, and this to a variety of standards, from the poorest " dowrah " to a fairly satisfactory house as in the Jamadoba collieries and the Kandi mines. Government have lately been actively promoting miners housing, and have been building a mining town of 500 houses with two rooms, kitchen, etc. The only defect about these houses is that latrines and water supply have not yet been provided. They are thought of last instead of first.

58. Housing of labourers in the jute and textile industries extends to a fraction of the total number of employees, perhaps about 10 per cent. This is of a frightfully low standard and one-roomed houses with more than one family in the room are found in many places. Every one recognises that these are bad, and a few enlightened industrial proprietors have introduces good housing. We have seen the good housing provided by the Harvey Mills, Madura, on the hire-purchased system, without recovering interest or land development charges. The colony is clean and the social effects of

good housing are reflected in the standard of hygiene of houses and in the children belonging to the colony.

59. The Railways have provided houses of some sort for most of their employees. The poor standard of the lowest class housing has already been raised suitably in all the new houses that are being built to the standards of the Mitra Committee.

60. The dockyard labourers are not housed satisfactorily.

61. In the steel industry the labourers as such cannot be said to have been provided with satisfactory houses. Some kind of house is available—either built by the labourer himself or rented out to him. The two-roomed houses built by Tata Iron & Steel Company are excellent, but they are too few and not available to labourers. Their rent (Rs. 12/- p. m.) is said to be too high, but even at that rent houses are not available in sufficient numbers. The lucky among the clerical or supervisory staff get them allotted after waiting for months if not years.

62. In the small and miscellaneous group of industries like glass, the housing accommodation provided is very little and very unsatisfactory.

63. When industries are newly established away from old towns, the housing of labourers is not unsatisfactory. The general rule seems to be that houses are built for labourers wherever they are considered a necessary inducement for attracting labour. Where labour can be easily replaced, housing is not provided.

64. If there is an industrial slump, houses for labourers will not be put up because they can be sent away, and, if there is an industrial boom as at present, houses cannot be put up because of lack of building materials and high costs of building. In either circumstance industrial housing suffers, and only enlightened employers realise their responsibility and the wisdom of providing satisfactory housing for their employees.

65. Labour is getting assertive and restive. It is unduly suspicious at times. When an employer offers free housing, it is construed as an interference with personal liberty. Where subsidised or low-rent housing is provided, the privilege is abused by overcrowding such houses with unauthorised persons, making profits out of them, and wilfully damaging the houses and fittings. We see manifestations of these abuses in railway colonies, etc.

66. Capitalists may look at the problem from their own points of view, and disclaim all responsibility for the environment of the labourer outside his place of work. This is a short-sighted, selfish and antisocial attitude. On this point the following extracts from paragraphs 27-28 of the Report of the Committee on Fair Wages (1949) are relevant :—

> "27. *Statutory and non-statutory benefits.*—Some of the employers organisations have urged that in fixing the fair wage, account should be taken of the statutory and non-statutory benefits allowed to workers. ......Some employers have provided first-rate housing while others have either done nothing in this matter or only made a show of providing housing.

28. We feel that before a wage-fixing machinery decides to make any allowance for benefits, statutory or otherwise, granted to workers, it must examine the nature and extent of those benefits. Where a benefit goes directly to reduce the expenses of a worker on items of expenditure which are taken into account for the calculation of the fair wage, it must necessarily be taken into account in fixing the actual fair wage payable. Where, however, the benefit has no connection with the items of expenditure on which the fair wage is calculated, it cannot naturally be taken into account."

In practice, wages are generally fixed on the basis of supply and demand. In para. 36 of the Report of the Committee on Fair Wages, it is stated : "An examination of the wage structure of different industries in this country shows that the wage differentials obtaining in industries have hitherto been based more on questions of supply and demand, accidents of history and socialogical considerations than on any scientific appraisal of the factors that should be taken into consideration."

67. Labour, particularly when it is well organised, dictates demand about housing which it is some times impossible to fulfil. The nation cannot afford to be an idle spectator of this clash of interests. Industrial production is vital in our economy for raising the standard of living and employment of the masses. It is, therefore, necessary for the State to fix by legislation a minimum standard wage in which the rental for the minimum standard of housing is distinctly shown... In fixing these minimum rates of wages, the first enactment specifically to regulate wages in this country is the Minimum Wages Act, 1948. This Act is limited in its operation to the so-called sweated industries in which labour is practically unorganised and working conditions are far worse than in organised industry. Under the Act the appropriate Government has either to appoint a Committee to hold enquiries and to advise it in regard to the fixation of minimum rates of wages or, if it thinks that it has enough material on hand, to publish its proposals for the fixation of wages in the official gazette and to invite objections. The appropriate Government finally fixes the minimum rates of wages on receipt of the recommendations of the Committee or of objections from the public. Steps should be taken to ensure that, under this Act, either a house or an allowance equivalent to the economic rent for the minimum standard house should be given to the labourer. If the problem is approached in this manner, the difficulty about building houses for industrial labourers will be eased to a large extent. It will not be necessary to build special colonies for them, segregate them and thereby develop the complex of their being a class of human beings at war with the rest of society. We commend this approach for solving this problem at least in the case of large-scale industries.

68. The minimum standard of housing for industrial workers may be the same as that suggested by us for the general public. We see no reason for treating them on a different footing. There should be cross ventilation in every living room by at least two windows whose aggregate area should be not less than 10 per cent. of the floor area. The kitchen should have a minimum floor space of 50 sq. ft. and a window whose area is at least 15 percent. of the floor space. The rooms and the kitchen should be provided with shelves.

The water supply to an industrial colony should be provided through taps if possible in each house in the courtyard, and in exceptional circumstances at the rate of at least one common tap for twelve houses. Houses should not be attached on more than two sides.

69. If single rooms and kitchens are allotted to a family, in exceptional circumstances, the room should be at least 200 sq. ft. in area, so that it may be divided into two by a curtain if necessary.

70. The Government of India realised the urgency of industrial housing as early as February 1946 and formulated a scheme under which they agreed to allow a subsidy of 12½ percent up to a maximum of Rs. 200 a house, provided the Provincial Governments also contributed a like amount. The response to this scheme was negligible.

71. After this the Industrial Housing Sub-Committee of the Standing Labour Committee (May 1946) recommended the starting of a housing fund to be administered by a National Industrial Housing Board, including representatives of Provinces, the Centre, States, employers, labour and other interested parties, with a whole-time Chairman. They also proposed Regional Industrial Housing Boards. They recommended that the Central Government and Provincial Governments should between them provide long-term interest-free loans, and employers should give Rs. 2 per month per house for every house allotted to them. They also recommended that any deficit not covered by the interest-free loan and employers ' contribution should be met by a further subsidy raised by some form of general taxation.

72. The Bombay Government formulated a modification of this scheme whereby each employer admitted to the benefits of the scheme should pay Rs. 2 per head per month and would get a preferential right to the allotment of houses in the scheme. When an employee was allotted a house the industry would pay a further one rupee towards the rental of the employee, who himself would pay 10 percent. of his emoluments. The Millowners ' Association did not respond favourably. We understand that they have denied any obligation to subsidise the housing of their employees.

73. The latest step taken by the Government of India to implement their industrial housing policy is contained in letter No. Fac. 32(30), dated the 13th April, 1949, from the Ministry of Labour to all Provincial Governments and Chief Commissioners (Appendix V). They have reiterated their decision, announced in April 1948 as part of their industrial policy, to construct one million houses in 10 years. For financing it, they have now proposed to give an interest-free loan to the extent of two-thirds of the cost of housing scheme, the remaining one-third being provided either by the Provincial Governments or by employers sponsored by them. The interest-free loan granted by the Central Government should be liquidated by a sinking fund in 25 years. The employers ' contribution to the scheme will be in the form of rent for quarters allotted to their workers at 3 percent. per annum of the cost of the house. The employee will pay either 2½ percent of the total cost of the house, or 10 percent. of the earnings of the wage-earners (at least two) who may be accommodated in a two-roomed house. It is too early to say what the response will be. The loan to be advanced by the Central Government will be substantial if the

response is good. We do not know if the Provincial Governments will be able to advance one-third of the cost of the scheme as loan, and if the employers will voluntarily join a scheme in which they will be required to pay, on the basis of a contribution of 3 percent. per annum of the cost of house, Rs. 13-8-0 per house allotted to a worker in places like Ahmedabad and Rs. 18-12-0 in Calcutta or Bombay. The idea of allowing two families in a two-roomed house is a lowering of the minimum standards that Government have accepted and is regrettable.

74. The whole question hinges on the economic rent and the prevailing wages. If the minimum wage is fixed by law and contains two distinct parts, one to cover the rental of a house and the other to cover food, clothing, health, education, etc., reasonable recurrent charges on a house can be assured to the party who invests. The houses will then be built in large numbers by various agencies. It will be a public utility, subject to control by the State in the matter of profit. We think the ultimate solution lies largely in this approach. If this is accepted, more than 50 percent. of the million houses required for industry can be built as public utilities by public housing corporations and the speculative appreciation of land values can be eliminated. The State can own the land and lease land and lease it to the Corporations to develop, and thereby reduce the cost of housing. There are several social, hygienic and economic advantages in developing a mixed neighbourhood rather than a purely reserved labour colony. The return on investment will also be better. Circumstances may, however, require the development of a purely industrial colony in some places.

75. Government should adopt a firm attitude with respect to industrial housing and divert the Excess Profit Tax towards solving this problem.

G. Housing Co-operative Societies

76. A fair number of houses can also be built through Housing Co-operative Societies. The benefits of the operation of these Societies have been confined so far to the middle-class people. But it results in house ownership, which is a strong motive for building a house of a higher standard and maintaining it cleaner. Many such societies started one or two years age have been obliged to slow down their programmes owing to non-availability of building materials. Government should make adequate allocations of cement and steel to these societies expeditiously, and acquire land for them quickly. Government should also ensure that provision is made for water supply, drainage, refuse collection and other services to the colonies developed by such societies. The societies will be able to build more quickly if instead of paying for the land outright, they are given the right to take the land from Government on a lease and sub-lease it to those who want to build.

77. If a large number of co-operative societies wish to operate, they should be encouraged to work in the same neighbourhood as far as possible so that amenities and transport may be provided more economically and efficiently.

H. Substandard Houses

78. There are many slums, hovels, and bustees in almost every town. They are veritable plague spots. Generally speaking municipalities have not

been able to do much to improve them. Their financial resources are limited, and their constitution and procedure are cumbersome.

79. The reasons for slums are poverty, the low standard of hygiene commonly tolerated by the poor and the acute shortage of housing at a rent within their means. In cities the cost of land is high, and the cost of building is also high. Few can afford to pay for both. The speculator invests on the land, and leases it out till he can find the capital to build or till he can sell it for a higher price. The man, who pays ground rent for such high value land, puts up only bustees as the land is not his own. He lets them out to their poor labourers who take them as it is the only accommodation within means. They live there at the cost of their health and spiritual stature.

80. Slum clearance is the responsibility of the State. However, the question of compensation holds up many slum clearance schemes. We are of opinion that no one has a right to produce a slum and then demand compensation when the State intervenes to clear it. We recommend that the Central Government should enact a law of compensation to enable Provinces and Improvement Trusts to proceed with slum clearance schemes without being overwhelmed by claims for compensation.

81. Slum clearance has often been done by Improvement Trusts in manner that increases the misery of slum dwellers and sometimes transfers the slum to a new location.

82. New accommodation must be ready for slum dwellers before asking them to clear from a place. In the present state of housing shortage in our towns, we would urge a suspension of all slums clearance for five years till an adequate number of new houses are built. After that it may be resumed.

83. Often a place becomes a slum on account of sub-standard arrangements for water supply, drainage, latrines, and refuse collection service. Instead of going through dilatory procedures for finding the owner of a slum and compelling him to provide these amenities, the municipality should be enabled to effect these improvements at its own expense for the next five years. The health authorities of the municipality should make an assessment of the most important defects and, on their certificate, the executive of the municipality should be authorised to spend money for this purpose, half from municipal funds and half from a special Government grant which may be made for this purpose. We think that a token grant of Rs. 4,000 per slum or bustee by Government may be adequate.

84. Municipalities should be vested with summary powers to carry out such improvements and recover the cost from the owner of the bustee as the first charge on the property.

85. There are many substandard houses. A civic survey may be conducted in respect of houses in each urban area spread over two years. A survey form and a system of scoring can be devised to show the most important respect in which the houses fall short of healthfull standards. The person responsible for rates should be given a time limit to rectify the defects on pain of a prescribed penalty. This method would be most effective in small munici-

palities and panchayats. However, if the improvement of substandard houses is to be achieved, it cannot be done only by legislation. There should be sufficient staff for conducting a survey, issuing notices, examining whether the defects has been rectified and, if not, prosecuting without fear or favour. The staff now available is inadequate to administer such a legal provision. We have had no time to go into this question in detail.

86. In villages, the main defects in houses are the absence of a latrine and the absence of a safe water supply. The former should be provided by the house owner. The agency of the gram panchayats that are being created may be utilised for rectifying this defect. The Panch should be charged with the duty of insisting on the provision of a latrine and a manure pit in every house. The Government should take steps to provide the water supply. If these are done, most village houses can be considered improved to a hygienic standard.

CHAPTER IV.

TOWN AND VILLAGE PLANNING

A. Urban Planning

Although the chapter on town and village planning follows housing, actual town and village planning should always precede housing. The reasons for our reversing the natural order is this. The aim is pointed out first and the means to achieve it next. As houses are needed badly, but should not be built anyhow, the town and the village should be planned. Planning is the means of achieving the aim of good housing, but not an end in itself so far as environmental hygiene is concerned.

2. Town planning for existing towns should be undertaken only after a civic survey and should aim at producing the broad outlines of a Master Plan. However, the acquisition of land for building new satellite towns may be delayed unduly if we are to wait for the completion of civic surveys and master plans for all towns. The acquisition of sites for new satellite towns as envisaged in the chapter on Housing may therefore be proceeded with as expeditiously as possible, on the advice of the Public Health Engineer of the province or town. He is expected to have an appreciation of the merits of the site from the point of view of foundation, ventilation, water supply, drainage, etc., and his approval should be essential in every case.

3. A civic survey is also essential for an Improvement Trust scheme of slum clearance. It may be that many houses can be improved instead of being demolished. Merely widening a road and beautifying the front elevation does not radically alter a slum. Such a survey is not necessary for other town planning *de novo* for a satellite town on a vacant plot of land.

4. Land is a big item in the cost of development. If there is an opportunity for frequent change of ownership, its value reaches impossible limits. We would therefore prefer the acquisition and retention of land by Government or the public in large blocks which should not be parcelled and sold, but only parcelled out and used, as indicated in the chapter on housing. In that scheme, Government is the owner of the land and leases the whole of it to the Housing

Corporation or Trust which is not free to dispose of the land any further in bits, but should build houses, maintain them at approved rates based upon classification and area. Thus the speculative element in value of urban landed property can be eliminated directly in these schemes, and indirectly in their neighbourhood.

5. In town planning *de novo* for satellite towns, it is desirable not to deviate from the following standards.

6. Gross density should be not more than 10 houses to the acre for the upper and lower middle classes *i.e.*, for A and B class houses and not more than 20 houses to the acre in C class houses for the poor. In one or two storey development in ordinary suburban housing, the floor space index may be kept below 0·5. Vertical development may be optional and will be indispensable in areas where land is scarce as in the present congested towns. In places where vertical development is planned, the floor space index may be limited to 1·5. In other words, if three stories are allowed, not more than one-half of the site should be built upon and, if four stories are allowed, not more than three-eighths of the site should be built upon. Where the floor space index exceeds 1·25, buildings should be planned in open plan forms, staggered, so as to offer the least obstruction to light and air. There is scope in such development for progressively reducing the proportion of window area in the upper floors, as the angle of obstruction from neighbouring building becomes flatter. This is the considered view of the Lighting Committee of the Building Research Board of the Department of Scientific and Industrial Research in the United Kingdom (*vide* Post-war Building Studies No. 12, paras. 52, and 125 and 132). We are mentioning this because many people believe that single-floor development is the best for town planning. This is rather wasteful of land, which we have to use it more economically now than in the past. The bungalows with one or two acre compounds that are found in the " civil lines " of some cities and in certain parts of New Delhi look incongruous and mediaeval in their setting amidst the overcrowded slums adjoining them. Open spaces are required, but we can ill afford to be lavish about them in new housing projects that are urgently needed.

7. In new satellite towns and suburban planning, the gross density of population may be about 60 per acre but not more than 120 per acre. In schemes that are intended to reduce congestion in existing towns, the aim should be to reduce the density to at least 250 per acre. If such a density can be achieved in the heavily congested parts of Calcutta, Howrah, Kanpur, Lucknow, Allahabad, Bombay, Ahmedabad, etc., a great deal of relief will be experienced.

8. In town planning, the roads should be designed to ensure swift movement of traffic consistent with safety. In the places where fast and slow traffic are both likely to use the road, the width should be sufficient for segregation of traffic in lanes. The surface should be suitable for the kind of traffic using it. Through roads should avoid passing through residential areas. They should afford a clear vision avoiding sharp curves and obstructions. Level crossings should be replaced by separation of grades if the volume of traffic is heavy. The width of roads should be fixed in relation to their function and

traffic load, and we cannot generalise on it. The standard of lighting at night on the roads and streets will depend on the traffic and on the amount of light available from commercial illumination.

9. We are of opinion that the so-called " service lanes " behind houses prove to be repositories of filth and should be eliminated. It is less objectionable to unload goods in the front road than to pile up filth in the back lane.

10. Parking places, vehicle stands, bus stands, shelters for bus and tram passengers, pedestrain crossings, traffic islands, round-abouts, and sites for petrol pumps should all receive adequate attention in planning. Public conveniences should be provided wherever people are to assemble or wait, as in parks, markets, bus stations etc. and they should be adequately lighted at night.

11. In town planning, we wish to stress the importance of water supply, drainage, lighting, refuse collection and other services. The cost of these services can become disproportionately high in dispersed planning. We have seen instances of town planning in which these things were thought of too late, after allowing houses to be built. These aspects of town planning require sound technical knowledge and experience, particularly in the design of water supplies and sewage systems.

12. In every town planning scheme there should be provision for certain essential buildings and amenities. There should be a shopping centre, providing for one shop for about 200 to 400 pe ple. Besides this, there should be a few dispersed petty shops, at the rate of one for 300 to 400 people. Provision should be made for a school or schools, clubs, parks and play-grounds, and small service indt stries in a residential area. There should be provision al o for a health centre and/or hospital according to the size of the population ; fr a post office and other public offices ; for places of worship ; and for places for disposal of the dead. In the planning of satellite towns outside existir g municipal units, consideration should also be given to the site f r sewage dispo al works, trenching ground and refus incinuerator or refuse dump.

13. Old towns were planned well according to the ideas of sociology then current. Excellent towns have been planned around a central temple, in squares connected by broad cross roads, and people of the same occupations used to live in one street or sector. In a secular State, we may not have the temple as the centre of communal life. The municipal building is a poor substitute for it. The civic centre seems logical in the present age. The centre of learning and the centre of healing should be away from the bustle of the physical centre of the town.

14. The planning should provide for zoning to segregate industrial areas, big transport centres and godowns, dangerous and offensive trades, and dairies from residential areas and business areas. This is very important and has been badly neglected in the past. Proper zoning will help in the regulation of peculation in land values too. There should be a thinning out of the population from the centre to the fringes, and, if possible, a green belt all round. The lanning of the residential areas should ensure a fair mix-up of all social groups nd avoid too much segregation.

15. In planning of new towns, the population should be limited to 100,000. However, the opportunities for such planning may be few. It will not be possible to reduce the size of existing towns.

B. Planning in villages

16. There is a paramount necessity and plenty of scope for town planning in urban areas, both for improving existing towns and for establishing new neighbourhood units of about 10,000 to 20,000 as we have suggested in the chapter on Housing. But the position in villages is a little different. Few new villages are being established. Where they are being established, all the principles of planning will have to be applied. There may be scope for this when villages are being shifted on account of malaria or frequent inundation or because they will be submerged by a reservoir when a dam is built. Such opportunities are rare.

17. In existing villages there are many defects from the town planning point of view. The structure of the village has a pattern that varies from province to province. It is well-developed into a plan and has streets, temples, grazing grounds, etc., in the Madras province and Mysore State. It is a loose and nebulous collection of houses set amid ponds and served by no roads in West Bengal. There, one village merges into another, and the whole area is under rice cultivation or water. The villages in the Central Provinces and Berar and in the United Provinces are compact and well separated from one another. They have some sort of streets. The villages in Rajputana and Bombay are congested almost like towns. On the Malabar coast, they are full of pretty detached cottages on large grounds. Few villages have a satisfactory water supply, and none has any satisfactory arrangements for disposal of excreta. Houses are not inadequate and not too badly over-crowded. But windows are few and lighting is poor. The people live in unduly close proximity to animals. The insect pests are innumerable.

18. It is difficult to carry out any planning in such villages. The people are poor, but their modes of living have taken deep root in their environment. They cannot be uprooted to a new village with new houses. They own their old houses and cannot afford to give them up and build new houses, even if they were willing. All that can be done is to improve communications, to open up a road if there is none, to provide a water supply and a grazing ground for cattle, and to persuade the villagers (*i*) to put in a few windows and keep them open, (2) not to live with cattle, and (3) to put up latrines of a sanitary type. Their school should be housed well and sanitated. A model house built in the village may have an educative value. This kind of work is really not planning in the sense of town planning. It is all round planning for village uplift, with an emphasis on the individual whose self-help and co-operation are all important but who is too ignorant to practice and too poor to change his environment in a hurry. The Health Survey and Development Committee desired to accomplish this through personal contact by the sanitary inspector, the doctor and the nurse. It looks as if we will not be able to implement that scheme in the near future. If the Gram Panchayat movement develops well, a little expenditure on public health engineering works in villages, such as water supply and technical guidance, may be able to evolve sufficient

interest in members of the panch. It may be canalised for village planning. It is also possible that the people may accept what is given as a gift without doing anything themselves.

19. We have some definite plans for certain items of improvement in the rural environment and these will be detailed in a subsequent chapter. If satellite towns grow up at the rate planned, it will have an educative value for villages in the neighbourhood. We may then expect a voluntary effort on the part of villagers to effect the necessary improvements.

20. If there is an occasion to plan and build a model village, we consider that the gross density of population should be restricted to 20 per acre. A water supply should be provided. Houses should be served by streets. There should be an open space for a gathering of people for any purpose, such as the poojah worship in Bengal, or for listening to a public radio. A school should be built with playgrounds, a public library and equipment for vocational training. A part of the village should be reserved for the carpenters, blacksmiths, bricklayers, weavers, potters and others. Every house should be built with sufficient ventilation at least two rooms, a kitchen, and a latrine. The houses should be detached or semi-detached, and should have space for erecting a cowshed and locating a manure pit. One or two model houses of cheap local materials should be built and given to the school teacher or midwife or whosoever can be expected to render the greatest social service to the community. The villagers can be encouraged to put up their houses on a co-operative self-help basis, as we saw in certain villages of Adikarnatakas in Mysore and in the new agricultural colonies in Hyderabad. The village should also have a hut for accommodating local officers on tour or stranded travellers.

C. Regional planning

21. Regional planning is the regulation of development of a whole area, district or province, so that one part may not grow in a manner out of harmony with another. In drawing up a Master plan for a big city like Kanpur, Bombay or Bangalore, one has to think of an area beyond the municipal units, even for 10 or 15 miles, and set apart certain areas, for industries, airfields, roads, harbours, residential areas, etc. To this extent, regional planning has a definite place and should be undertaken and approved by the State. However, regional planning by a town planner becomes unreal if one tries to extend its application to whole areas exceeding 500 square miles. Regulation of the use of space is not the only factor or even the most important factor in the development of a region. Whether an industry does develop in a plane allotted for it depends on many many factors. The town planner should not be saddled with the responsibility for deciding what should develop where. His role should be to accommodate within limitations a particular development planned by the people of the area. Decisions in all-round regional planning should be taken by the entire Cabinet on the advice of all Ministries concerned. The Provincial Government should declare an area as an industrial area in the case of ordinary industries and the Central Government should make a similar declaration in the case of industries of National importance. However, the location of new industries involving more than 100 workers should be decided on only after reference to the Public Health Engineer of the Government who

will consider the effects of the location from the point of view of river and stream pollution, air pollution, etc. The new Factories Act, 1948, reserves this responsibility to the Chief Inspector of Factories in accordance with the rules framed by the Provincial Government. We think that it should be a joint responsibility with the Health Department and that the rules to be issued should make this obligatory. The site for a factory should be approved by the Public Health Engineer of the area and the Factory Inspector.

D. Improvement Trusts

22. Improvement Trusts have been functioning in Delhi, Kanpur, Allahabad, Lucknow, Calcutta, Nagpur, Bombay, Hyderabad, Bangalore, Mysore and Madras. The Bombay Improvement Trust was merged with the Municipal Corporation some years ago. The Kanpur Improvement Trust has grown to the stature of a Development Board. All these bodies have done very good work over a long period of years in developing land for building purposes, clearing slums, providing civic amenities and beautifying cities.

23. The question whether municipalities cannot perform these functions is easily answered. When the improvement needed is of considerable magnitude, a small executive body like an Improvement Trust is better suited to carry it out. A municipality is constituted as an instrument for maintenance service and is rather ill-adapted for construction.

24. Till now, Improvement Trusts have acquired private land or taken possession of Government and Municipal land for their various sanctioned schemes. They have developed land, laid roads, drains, water mains and sewers inside their schemes, divided the area into plots according to their plans and sold them or leased on them out to private parties for building purposes. Improvement Trusts have been excellent instruments for stimulating housing for the upper-middle class.

25. Not all Improvement Trusts have employed a competent town planner. A few of them have assumed the availability of water supply, drainage, etc., too easily and realised after developing and selling the plots that the municipalities concerned are unable to serve them except at enormous costs. This has led to public dissatisfaction, as at Nagpur.

26. Operations of Improvement Trusts have tended to raise the value of land and to increase speculation in land to some extent. The provision of housing for the poor becomes more difficult when these tendencies operate. One may say, therefore, that most Improvement Trusts have not improved the lot of the poor. The Hyderabad City Improvement Boards is an exception. It undertook planned housing on a large scale along with demolition of slums. It had the benefit of assistance in several unseen ways from the State Government. Other Improvement Trusts are not so fortunate. They have to work on limited funds and make the most out of land that has been developed to buy more land for their schemes.

27. In developing land, we noticed a tendency for some Improvement Trusts to be rather free in spending money on roads, etc. It is no doubt an excellent thing to spend nearly a rupee per square foot on developing land, but this puts up the cost of the site and house, and the rent and everything-

else. The beautiful environment recedes further and further from the reach of the poor. What does it benefit them if they are allotted a " hutting space ", or a bustee plot in an area developed at Rs. 50,000 to Rs. 100,000 an acre ? If Improvement Trusts had not only to develop but also build houses, they would adapt more economical standards and would develop the land progressively as buildings grew. Water and drainage are the first priorities in development. Serviceable roads will suffice in the beginning. Cement concrete roads can wait till the buildings grow. Improvement Trusts should seriously consider economies in development costs without materially reducing the essential standards of planning.

28. We would also urge that, before people are dehoused, provision should be made for rehousing them. To build houses for them costs money, and Trusts cannot find the money till they demolished the slum, construct roads and sell the land as high-value plots. They should have larger funds to operate as working capital in such cases.

29. There is no reason why Improvement Trusts should not carry out other types of improvement besides land development, such as a Water Supply Scheme or a Drainage Scheme. Government should constitute such Trusts where the volume of works justifies it and municipalities are not in a position to undertake the work.

30. When an Improvement Trust lays down roads, sewers, water mains, etc., it should either lay them to the standards acceptable to the municipality that will eventually take them over or have the work done by the municipality. There should be better co-ordination between Improvement Trusts and municipalities. The former cannot supplant the latter. When an Improvement Trust has completed a particular improvement, the municipality should take it over for maintenance as was done in Bombay.

E. Legislation and administration

31. We have indicated the complex role of planning. It is obvious that it cannot be entrusted to persons without adequate training. The Madras Town Planning Act called upon Municipalities to prepare town planning schemes before a particular date, when they had no competent person to plan. If they failed to prepare the schemes, it is understandable. If they did submit schemes, they would have been amateurish. There is no reason why planning should be confined to Municipalities. They are likely to be conservative and different about developing new areas for housing, as it means an initial expense on roads, water supply, development, etc., which they cannot afford. They are not constituted for taking the initiative and implementing policies quickly. They would prefer the work to be done by somebody else, and only the benefits of increased valuation passed on to them. When the Madras Government found no response from the Municipalities in the preparation of new town planning schemes, pressure was applied and some schemes were prepared. These are being executed through a staff that does not appear to be particularly trained for their duties.

32. We consider that those Provinces which have no Town Planning Acts should enact them immediately. We find that the existing Acts in some

Provinces are inadequate. They should be amended. Their scope should extend not only to urban areas but to all areas where a housing development on 10 acres or more is contemplated by any authority—municipality, panchayat, Government Department, public company, factory, or housing co-operative society. The provincial town planner should be authorised to scrutinise, approve and assist in the preparation of such schemes. On his advice, Government should be enabled to take a decision on a scheme after giving time to the local authorities to object. He should get trained staff, or should take engineers and draftsmen and train them. On his recommendation, the Ministry of Health should grant licenses to practising town planner. The organisation of their training will be discussed in a subsequent chapter.

33. If the bulk of the new housing recommended in our short-terms plan is developed as a public utility, the housing corporation that will be floated will be required to employ competent town planners, and the work of the Government Town Planning will be only to exercise general scrutiny of master plans and approve detail plans if generally satisfactory. As his work will relate to municipalities as well as satellite towns, his place will not be in the Local Self Government Department. Although land acquisition for satellite towns will be done through the land revenue department, the Government town planner cannot be attached to that department. We think his place is in the Ministry of Health, as adviser to the public health engineer. If the volume of housing directly undertaken by Government is large, but not very large, the public works department may handle it. If it is very large, a special Chief Engineer for Housing may be required. If the bulk of it is done by public corporations, only supervisory functions will be required regarding observance of standards, and those can be discharged by the Ministries of Health (being most directly concerned) through their public health engineers and town planners. It is our opinion that in the practical execution of large housing projects an engineer with knowledge of public health engineering, including town planning, will be more suitable than a pure town planner to direct and execute the work. The engineer's background is more practical and less visionary.

34. Provincial Housing Boards have been suggested by the National Planning Committee, the Madras Provincial Housing Committee and the Co-operative Sub-Committee of the Conference of Improvement Trusts and Development Boards. We understand that a Housing Board has been established in Bombay under the Ministry of Labour. The public housing corporations that we have in mind will do the rest if they are given the land on lease and can get a return on capital.

35. Provincial Housing Boards may be established as statutory bodies—with the Chief Public Health Engineer (suggested by us in chapter XVII) as Chairman, a Financial Adviser, and two or three members chosen for their administrative ability and integrity and appointed for a term of five years. These Boards may be authorised to float loans at $\frac{1}{2}$ percent above the Government borrowing rates and use them for land acquisition. They may be authorised also to license public housing corporations or to engage in housing activities themselves on the lines recommended in the previous chapter. Such Boards will be free from the shocks of political changes and will be able to pursue a

steady policy in housing. The direct financial burden to the State will be eased by these Boards and the State will not be required to do anything more than enabling them to function efficiently.

CHAPTER V.

WATER SUPPLY

Water is as important for living as are air, food and shelter. Water is also a great agent for cleansing, so necessary for maintaining a high standard for personal hygiene. An adequate supply of wholesome water of acceptable quality should therefore be considered first among the improved health services that a community needs. It has been recognised by Ministries of Health as one of the most important objectives of Government, but we regret to say that the practical steps taken in our country, to provide water supplies are very disappointing.

A. Survey of existing position

2. The report of the Health Survey and Development Committee contains a brief survey of the number of water supplies in India, the proportion of population served, the quantities supplied per capita per day, and the total capital investment calculated per capita. To re-capitulate, only 16 percent. of the total number of towns in India have protected water supplies, which serve 6·15 percent. of the total population or 48·5 percent. of the urban population. The supplies were designed to give 2 to 40 gallons per head per day. West Bengal, Madras, Bombay, the United Provinces and Delhi have comparatively more protected water supplies than Assam, Orissa, Bihar and the Central Provinces. Mysore State and Hyderabad State have more protected water supplies than many Indian Provinces. Dual water supplies are found in Calcutta and in some of the mills around Calcutta. Intermittent supplies are the rule ; the exceptions are the water supplies in some of the hill stations and the supply at Lucknow. Filtration plants are installed at many places, but the standard of maintenance of these plants is generally unsatisfactory. We have also come across instances where expensive plant has been provided in excess of the requirements of the situation, and instances where expensive equipment has lapsed into disuse through sheer neglect. Disinfection of water is carried out perfunctorily in some places, by operators who do not seem to be aware of their grave responsibilities. Water works laboratories at the plant for plant control are only a few. These are found at Calcutta, Jamshedpur, Poona, Bombay and Bangalore and to some extent in the larger water works of the United Provinces and Bombay Province. The output of research from water works plant laboratories is not considerable and statistical data regarding plant operation are meagre.

3. The strain on urban water supplies has increased enormously in recent years owing to—

(1) the overcrowding in the larger towns,

(2) the influx of refugees, and

(3) the indefinite postponement by municipalities and Government of augmentation schemes when they were due.

For example, the augmentation of the Calcutta Water Supply was due in 1941, and the designed population had been exceeded before that year, but construction has not been undertaken yet. On account of these reasons, urban supplies originally designed on the basis of 2 to 25 gallons per head per day have dwindled to 1 to 15. In their desperate efforts to save water, municipalities have cut down the hours of water supply further and the public have considered it wiser to remove most of the taps on the distribution system to be able to catch the few drops that may trickle down. Pumps and other water-works machinery have not been repaired or replaced in due time for want of spare machinery or funds in many water works. In some water works, the operators have been running rapid filters without coagulants and have shut down chlorinators, ammoniators and bleaching powder tanks for months as they have not been able to obtain supplies of chemicals. The results has been a great deterioration in the service rendered by existing urban water supplies since the Health Survey and Development Committee reported on them. Only a few water works are being augmented. Among these are the water supplies of Delhi, Bombay Kanpur and Bangalore. In most place new schemes have been shelved.

4. The deterioration in water supply has been worst p rhaps in Madras City, where the quantity is precarious and the quality nauseating in the dry months. And yet very little has been done to rectify the state of affairs.

5. In the rural areas and smaller urban areas, the water supply continues to be as unsatisfactory as it was when the Health Survey and Development Committee reported. There is very little protection in the water supply, as it is drawn from sources open to contamination of all sorts. High construction costs and difficulties in obtaining galvanised or black pipes, pumps, etc., have slowed down plans for improving rural water supplies in West Bengal, Madras, etc.

B. Plans drawn up by other Committees

6. The Health Survey and Development Committee drew up a planned programme for installing water supplies in India. Their target was to provide 50% of the population with safe water supplies in 20 years, and to extend it to the remaining 50% in the next 15 years. They recommended that the expenditure should be divided about equally between urban and rural supplies, that work should be commenced only after due investigation and location of suitable and adequate sources, that the first five years should be spent in organising the investigative and executive machinery, and that a Water and Drainage Board should be established in each province, consisting mostly of scientists and administrators, to establish priorities and standards, promote research, ensure the allocation of funds and facilitate the continued implementation of a steady policy by Government in the provision of water supply and drainage till the goal was attained. The Committee's plans for water supply were integrated also with their plans for other health services in that they planned to provide and maintain 100% water supplies in the primary and secondary health units, which were to be established, through a public health engineering organisation which was integrated with the rest of the health department. That Committee also planned to evolve more or less uniform standards and to ensure progress in

implement ation of their plans for water supply through a system of grants-in-aid from the Central Government. The expenditure recommended was at least Rs. 14 crores per annum for 20 years for undivided India.

7. Unfortunately, these plans of the Health Survey and Development Committee have not been accepted by the Provinces the Centre. Health Ministries have not shown sufficient practical interest or initiative in getting funds allotted and securing personnel and materials for promoting them. The Central Government itself has no public health engineer in the Ministry of Health and no system of grants-in-aid or loans to induce Provinces to promote new water supplies or improve existing ones. In the Provinces too, the Health Ministries have not achieved much.

8. The Madras Water Supply and Drainage Committee have drawn up a plan for provision of water supplies to all urban areas within ten years, but their recommendations have not been taken up yet. Bombay and the United Provinces have some post-war schemes to be implemented. Much greater zeal should be shown by Health Ministries in the promotion of water supplies than now.

C. A positive plan

9. In these depressing circumstances we may be pardoned for hesitating to suggest plans and targets. We would earnestly plead for more active interest on the part of Central and Provincial Governments in the provision of water supply. It is through their active interest that presidency capitals and hill stations got water supplies in the past. It is only with their active interest that this crying need of the rural and urban people can be met. Water supply for health is not a luxury or a welfare service. It is as urgent as water supply for irrigation in the drive for food production in many localities.

10. We are suggesting the following modest plans, taking into consideration the urgency of other post-war plans and the scarcity of money and materials. We hope that they will be carried out in full within five years. They are elastic enough to accommodate any variations desired by provinces.

11. In view of the rapid deterioration in the water supplies and in the living conditions in towns of over 50,000 population, we recommend that the improvement of existing water supplies or the provision of new supplies in such towns should be taken up immediately. As new houses have to be built mostly in these cities to relieve the present shortage of houses, the improvement of their water supplies is an essential pre-requisite. They should be brought up to standards suggested by us in a later section. We cannot say anything about the order in which improvements to existing water works should be taken up. Naturally these works in which the strain due to wear and tear of machinery has reached the danger point and those which serve populations more than 25% in excess of the designed populations should be taken up earlier than others. The initiative for effecting improvements may not come from municipalities, as they have limited resources and limited vision. The heath and living conditions in larger cities are of more than local importance. They have repercussions on the neighbourhood. Hence , we would urge Government to look into the question of improvements to existing water supplies of

towns over 50,000 on their own initiative, and arrange to effect them irrespective of whether the municipalities concerned agree to them. The provincial Governments should increase the normal grant for such purposes, and the Central Government should advance loans to Provinces for financing such schemes. The total expenditure involved can only be guessed. We think it may be about Rs. 30 crores, to be incurred in five years in order to keep pace with the housing projects. The financial burden of Rs. 4 to 8 crores a year may be shared as follows—the Central Government may give a grant-in-aid of 10% of the cost and a loan to the Provincial Government concerned equivalent to 90% of the cost. The Provincial Government may in turn give, in addition to the Central Government's grant-in-aid of 10%, a grant of 40% of the cost and a loan of 50% of the cost to the municipalities, and get the work completed departmentally, waiving half the departmental charges for investigation and execution. We understand that, in West Bengal, there are municipalities, big and small, which are not in a position to undertake water supplies even with two-third grants-in-aid from the Provincial Government.

12. Protected water supplies should also be installed in housing projects for the accommodation of displaced persons. The cost should be shared equally between the Provincial and the Central Governments. Here too the Central Government can advance a loan to provinces to cover the latter's share of the cost. The cost may be about Rs. 18 crores to be spent in five years.

13. We also recommend that every pilgrim centre in India which is likely to attract more than 10,000 pilgrims in a year should be provided within five years with a piped, protected water supply. These pilgrim centres are the focal points of epidemics and have been the cause of worry to health departments for decades. Wherever protected water supply has been introduced, the control of water-borne epidemics has become easier. Gaya, Puri, Hardwar, Kurukshetra, Tirupati, Rameswaram, etc., have all been provided with protected water supplies. Some of them require improvements. The cost of these water supplies should, in our opinion, be borne by the Provincial Government. In the case of certain centres of all-India importance, the Central Government should give a grant-in-aid of half the cost to the Provincial Government. We are unable to guess what the cost will be. Till the Provincial Governments are able to complete these water supplies, we suggest that their public health engineers should maintain lorries fitted with pumps, filters and disinfection plants with sufficient staff for putting up temporary water supplies in the field through storage tanks and public stand-posts. The Central Provinces Government have already organised this service satisfactorily.

14. Next in importance we would suggest that at least 75% of the population, both urban and rural, be provided with safe water supplies (and hygienic arrangements for disposal of excreta) in districts where cholera is endemic. Some amount of useful work has already been done by the Governments of Bengal and Madras in the provision of rural water supplies out of a rural water supply fund that was created in 1930, but the work has been nullified by the absence of a State maintenance service for the wells and tube-wells put down. Rural water supplies were entrusted to wrong agencies in many cases and, as one Honourable Minister told us, water was poured into some of the wells at the time of in section of the district revenue authorities. Such failures should be avoided.

We suggest that the provision of water supplies for all people in districts having endemic cholera be taken up first in those districts where the mortality on account of cholera over a decade has been 100 or over per 100,000 per annum. According to the Health Atlas of India, these districts are Gonda, Hamirpur and Banda in the United Provinces ; Gaya and Bhagalpur in Bihar ; 24-Parganas and Hooghly in West Bengal ; Cuttack and Balasore in Orissa Drug, Nagpur Wardha, Yeotmal, Akola, Amraoti, Buldana, Betul, Jubbulpore and Hoshangabad in the Central Provinces ; and Khandesh in Bombay. Of these Gaya, Cuttack Amraoti and Buldana are the worst affected and should receive the highest priority. In these districts, the Provincial Government should launch a programme of piped water supplies for all towns (*i.e.* units having population of 5,000 and above) and supply from wells for all villages (*i.e.* units having population below 5,000). The wells should be fitted with pumps as far as possible and there should be a sufficient number of wells evenly distributed to serve the people. In a later section we shall state more precisely the desirable standards of sufficiency and spacing of sources of water supply in the rural areas. The cost of water supply in these areas should be borne by the Provincial Government and the Central Government in the proportion of 2 to 1, and the Provincial Government should also undertake the maintenance of these water supplies. The population involved is nearly 30 millions and nearly 90% of them live in rural areas. It may be possible to provide water supplies at a cost around Rs. 25 crores in five years. The Central Government should set aside Rs. 1·67 crores a year for water supplies in cholera-stricken districts and out of these funds contribute one third of the actual expenditure on water supplies in these districts if the Provincial Governments contribute two-thirds.

15. At the same time, the provision of wat r supplies in areas of great water scarcity should be taken up. These are in the ceded districts in Madras, in the famine-stricken districts of the Deccan plateau, at Ahmedabad and in many parts of Kathiawar and Rajputana. They are also found in small patches in other district. It will be expensive to provide piped water supplies of the usual standards in these areas. However, a planned programme should be followed in providing drinking water to these places. Water-supply to these places should be linked up with irrigation projects and hydro-electric power projects in the neighbourhood. Whenever water is taken through these tracts for irrigation the first consideration should be to provide a water supply to them. Electrification of rural areas deserves special consideration as it generally facilitates the provision of a piped water supply. We are unable to guess what the cost of such projects will be, but consider that provinces should set apart a definite sum each year for such expenditure. If necessary, the Central Government may advance loans to the Provinces concerned.

16. In addition to the above, if an all-round intensive health programme is taken up by any province on the lines of the Health Survey and Development Committee Report, it should include the provision and maintenance of water supply in the area to be developed. This impersonal health service should be integrated with other personal and impersonal health services, in order to bear fruit. We are unable to say what the cost of this proposal will be, as it depends on the rate at which the health services are to be intensified in particular areas. We wish to emphasise however, that the development of primary

health centres should not be undertaken without inclusion of suitable personnel and sufficient money for improving the water supply and excreta disposal. We find such lop-sided projects being put up, and wish to warn their authors that the results are bound to be disappointing.

17. Even the short-term plans outlined in the preceding six paragraphs will require a strong organisation in public health engineering in the Ministry of Health. This is lacking in some provinces now. We are of opinion that the proper place for public health engineering is in the Health Ministry. The question as to how it should be organised and how the personnel should be trained will be discussed in a later chapter. We are of opinion that water-supplies and other public health engineering works can be designed and maintained satisfactorily only by engineers trained to assess and appreciate the public health implications of the works they are called upon to scrutini e or build. This duty cannot be discharged satisfactorily by the engineers in other fields, such as irrigation, highways, railways, electricity or mechanics. Nor can it be discharged by the medical officers of health who should be relieved of this duty so that they can devote more time to other phases of health work. We are of opinion that, in the present state of our country, the public health engineer should be entrusted as far as possible with the main responsibility for construction as well as design of works pertaining to his profession. This obtains in other fields of engineering in India. The man who designs should be allowed to build so that he may subdue impractical idealisms and take responsibility for the failure or success of his design. We do not fully agree with the view expressed by the Health Survey and Development Committee (para. 18, page 252, Volume III of their Report) that the Public Works Department " will be concerned with the construction and maintenance of water works and drainage". This system has not been very successful in the past and we have not yet reached the stage where our public health engineer can remain only an expert consultant and critic on environmental hygiene problems without executive responsibility

18. We recommend that plant control laboratories should be established in all important water works, so that the qualities of the article manufactured and supplied may conform to standards, just as it is done in other industries. These will not cost much money, but will provide the means by which the operator will keep a constant watch on the efficiency of his plant and adjust the production process. He will do so not out of fear of an external authority but out of an internal urge to comply with a standard that he is familiar with. The occasional collection and examination of a sample of water by the provincial laboratory is the only check on the quality of water now. It should be the means of corroboration by an independent authority of facts that the operator can find out for himself in his laboratory. By establishing these plant control laboratories, valuable operating data and statistics can be collected and fundamental research promoted.

19. The establishment of plant laboratories should be preceded by a system of training for plant operators.

20. As a long-term plan to be completed in 40 years, we would suggest the extension of the benefits of protected water supply to at least 90% of the

population in India. We would have suggested 100% but are aware that seldom does human planning succeed to perfection.

21. Assuming that their target in respect of water supply will be accepted and that their plan for providing water supply for all within 35 years will be implemented, the Health Survey and Development Committee recommended the setting up of Central and Provincial Water and Drainage Boards to ensure continuity of policy, finding of funds, continuity of planning, etc. The Boards were to consider the conservation, use and pollution of water on the basis of river basins. We are of the view that these Boards will serve a useful purpose. The programme set out by the Health Survey and Development Committee seems too ambitious in present-day conditions ; we have drawn up our short-term plans on a much more modest basis. If Government can declare its policy on this basis and resolutely find funds, the function of the water and Drainage Boards will be fulfilled. If not, they will be the bodies to plead with and urge Government to adopt this policy and implement it.

22. To sum up, our recommendations for a five-year plan are as follows :—

(*a*) To install new water supplies and improve existing water supplies in all towns of over 50,000 to check the rapid deterioration of urban water supplies and aid the programme already set out for new housing (para.ll)

(*b*) To install protected water supplies in housing projects for the accommodation of displaced persons (para. 12).

(*c*) To provide protected water supplies in all permanent pilgrim centres in India (para. 13).

(*d*) To provide protected water supplies to at least 75 % of the people in districts where cholera death rates have been 100 or over per 100,000 per annum during the last ten years (para. 14).

(*e*) To provide protected water supplies in areas of great water scarcity (para. 15).

(*f*) To develop and maintain water supplies in areas covered by health centres where intensive personal and impersonal health services are being developed (para. 16).

In addition we should—

(*i*) establish plant control laboratories (para. 18).

(*ii*) organise the training of plant operators (para. 19).

(*iii*) organise public health engineering services on a strong and sound basis in the Health Ministries and to entrust them with the responsibility for design, construction and maintenance of public health engineering works (impersonal health services) (para. 17.)

(*iv*) plan for gradual extension of protected water supplies to 90% of the population in 40 years (para. 20).

23. The financial implications of the five-year plan outlined above are—

(i) Probable expenditure by the Central Government of Rs. 5·05 crores per annum as grants-in-aid and Rs. 10·70 crores per annum as loans to provinces.

(ii) Probable expenditure by Provincial Governments of Rs. 8·72 crores per annum as grants and Rs. 3·00 crores per annum as loans to municipalities—a total expenditure of Rs. 11·72 crores, out of which Rs. 10·70 crores will represent loans from the Central Government.

24. The implementation of this programme will have immediate results in facilitating the housing programme, and will go a long way towards eradication of cholera, typhoid, dysenteries, etc. It will also help in the evolution of uniform standards of design, construction ahd operation in water works under the stimulus of a system of grants-in-aid.

D. Standard

25. There is a considerable lack of uniformity in the standards of design and operation of public water supplies, even within the same provinces in India. We recognise that there are many local limitations. Still, we consider that there should be a target standard and a minimum standard to be fulfilled by public water supplies. There are British and American standards of quality and quantity for the guidance of designers and operators, but sometimes these have to be modified to suit varying conditions in different parts of our country. Our recommendations are as follows.

26. The objective of a public water supply should be to supply water—

(a) that is absolutely free from risks of transmitting disease is pleasing to the senses and is suitable for culinary and laundring purposes,

(b) in adequate quantity for all domestic and public purposes for at least a generation (thirty years) from the time of installation,

(c) with the least possible physical strain to the consumers taking into consideration the local circumstances, and

(d) for at least 95% of the time.

As regards (a), freedom from risks is comparatively mere important than physical appearance or hardness. Safety is an obligatory standard, and physical and chemical qualities are optional within a range.

Clause (c) covers the problems of distances of wells and tube wells, the physical strain of lifting or carrying the water, the choice between public taps and private taps in a piped supply, and the choice between manual pumps and pumps operated by power, etc., in small public supplies.

Clause (d) covers the question of adequacy of storage reservoirs and sources of supply and less rigidly, the hours of supply, duration of break-down that is tolerable, etc.

27. In general, a piped water supply is preferable for communities of over 1000 as it is better adapted for fulfilling the above objective without serious economic strain. In any case, it should be considered obligatory for communi-

ties of over 10,000 in the long-term plan. For smaller rural communities, a supply from wells or tube wells may be provided if they are suitably protected against contamination and are maintained in a usable condition.

Piped water supplies.

28. Piped water supplies should be designed to provide water in adequate quantities for :—

(*a*) domestic purposes, such as cooking and drinking, bathing, washing and flushing of closets.,

(*b*) public purposes, such as street washing, flushing of sewers, watering of public parks and supplying to certain public buildings,

(*c*) industrial and commercial uses in towns, including air conditioning,

(*d*) animals used for agriculture, milk, transport, etc.,

(*e*) fire fighting, and

(*f*) normal waste (which is rarely below 10% even in metered supplies).

29. As every one of these items depends on the size, the economic importance and the standards of living of the community, we suggest the following optimum standards with a maximum permissible variation of +20% for adoption by different communities :—

(1) for communities 1000–5000, in the absence of sewerage, provide. — 15 gallons per capita per day.

(2) for communities 5000–20,000, in the absence of sewerage, provide. — 20 gallons per capita per day.

(3) for communities 20,000–50,000, in the absence of sewerage, provide. — 25 gallons per capita per day.

If sewerage is contemplated for these communities, add an extra 5 gallons per capita per day.

(4) for communities 50,000–200,000 provide .. .. .. 40 gallons per capita per day.

(5) for communities over 200,000 estimate requirements in respect of industrial and commercial uses, including air conditioning in detail and add it to 40 or provide. — 45 gallons per capita per day.

In the case of rural water supplies from dispersed sources, such as wells or tube wells, they should be capable of yielding at least five gallons per head per day. The optimum number of sources would be one for not more than 150 users and at a distance not greater than two furlongs from any house. The minimum number, even under extreme stress, would be one source for not more than 500 users, at a distance not greater than six furlongs from any house.

30. Provision for fire-fighting should be made in the case of water supplies for communities of over 10,000 as far as possible and for communities of over 50,000 without fail. About 25% of the requirements in America is considered sufficient in our country considering the nature of buildings, the occurrence of fires and the small number of buildings insured against fire.

31. In designing water supplies for the future population at the end of a term of years, the normal lag between design and completion of execution should be allowed for. In our country, this lag has rarely been less than five years and has often been 10 years. Before a scheme is taken up for execution, the design

population should be checked and, if the actual population has approached it or exceeded it, the design should be immediately revised. We recommend that, in future, the time-lag should ordinarily not exceed two years and, even in exceptional circumstances, not exceed five years. A decision should be taken quickly on each supply. Augmentation or improvement of a water supply, when due is more likely to be put off by a small community than by a larger one, owing to differences in financial resources. Hence the term of years for which a small water supply is designed should be slightly longer. We recommend the following terms of years as the optima for design purposes in India :—

Water supply communities.	Years for pumps.	Years for distribution system.	Years for storage reservoirs.	Normal time lag in years between design and execution.
Under 50,000 ..	20	30	40	5
50,000 to 200,000 ..	15	25	40	3
Above 200,000	15	20	40	3

There will, however, be many cases, in which these periods may have to be varied to suit local conditions.

32. Water supplies should be designed to give adequate pressures at the consumer's end and for fire-fighting purposes. This will depend on the height of buildings in the town. In towns of over 200,000 or where buildings of three or more stories are common, the minimum residual pressure should be 50 feet. In towns of population between 20,000 and 200,000 or where two-storied buildings are common the minimum residual pressure should be 35 feet. Where one-storied buildings are common, the minimum residual pressure should be 22 feet. If absolutely necessary, these recommended standards for residual pressures may be relaxed by reduction of eight feet.

33. The provision of pure and impure water supplies side by side in the same area carries with it grave risks to public health and is not justifiable. Such arrangements should not be permitted in new water supplies, and should be rectified as early as possible in existing water supplies.

34. Intermittent water supplies should be discouraged as far as possible. In our opinion, they result only in dissatisfaction, waste of water, inequitable distribution and risk of contamination of water by back syphonage or insuction during hours of low pressure. Intermittent supplies are also open to the objection that the flushing of closets is interrupted and the fighting of fires is impossible during the hours of interruption. It has been demonstrated recently at Lucknow that the water-works authorities can successfully supply water all the 24 hours, educate a community used only to intermittent supply to adapt themselves to continuous supply and reduce their consumption. Even in intermittent supplies, a judicious readjustment of the hours of supply will reduce waste.

35. Cross connections between public and private supplies should be disallowed.

36. Mains should be designed to supply the maximum requirements of water, taking into account the probable frictional resistance 8 to 10 years after being in service. Supply mains should be designed for a minimum carrying capacity of 140 to 150% of the average daily rate of supply. Distribution mains should be designed with a minimum carrying capacity of 225% of the average rate of supply for populations over 50,000, 250% of the average rate of supply for populations of 5,000 to 50,000, and 300% of the average rate of supply for populations under 5,000. If supplies are designed to operate intermittently, the carrying capacity of the main should be based on the number of hours during which the day's supply is proposed to be given, and increased by 50%.

The minimum carrying capacity of a distribution main should be at least 400 gallons per minute where provision is included for fire-fighting. No main less than four inches in diameter should be allowed in business areas or where provision for fire-fighting is contemplated. This restriction may be relaxed in cases of small water-supplies and temporary water supplies.

37. The design of distribution systems has not received the care it deserves and we find that, in many towns, service connections are taken in excess of the carrying capacity of the system. We recommend the adoption of the more refined techniques that are available now, such as " Hardy Cross Method ", " Method of Sections ", etc., to check the design of distribution systems and also field tests to varify their actual pressures and carrying capacity.

38. The residual pressures specified in paragraph 32 above should be available under the worst conditions of:—

(*a*) peak draw-off, and

(*b*) average draw-off and fire-fighting at the same time.

Pipes and mains should be designed as far as possible with standard specials, and the number of special specials required should be reduced to the absolute minimum, in order to reduce costs and delay in procurement of materials.

39. Devices for measuring and recording the flow and pressure of water should be provided at suitable points to enable the operator to maintain statistics about consumption and trace waste of water.

40. The treatment of water in a public water supply should be adequate but strictly limited to the necessities of each case. Luxury equipment or unnecessary equipment should not be installed when the quality of the raw water does not warrant it. We have seen ammoniation units, lime-dosing equipment, etc., being ordered without consideration of the quality of the water and other essential things being omitted.

As the foremost aim is to produce a safe water, efficient disinfection of water should be provided for in all supplies except those where the source is unquestionably safe (as from deep tube wells, completely protected springs, etc.) However, if there is any risk of contamination in the distribution system, disinfection should be provided for.

The extent to which settlement, filtration, etc., are carried out should depend to some extent upon the size and resources of the community and its own tolerance limits.

We suggest that water purification plants should be designed so as to make use of local materials as far as possible.

We wish to remind designers that intermittent water supplies generally require a larger design capacity in filters, etc., than would otherwise be necessary, and that they result in heavier capital outlay.

We have noticed a lack of uniformity in procedures adopted in different laboratories in the bacteriological examination of water. The quantitive estimation of the most probable numbers of Coliform organisms by the standard procedures of the British Ministry of Health or the American Public Health Association is, in our opinion, the best way of judging about the bacteriological quality of a piped water supply. Every water works supplying more than two million gallons per day should, in our opinion, have a laboratory and personnel suitable for carrying out these tests and recording results within the water works.

This laboratory should also be equipped with apparatus for determining turbidity, colour, pH, alkalinity and acidity, optimum doses of coagulants, hardness, chlorides and residual chlorine.

It is preferable to equip the laboratory also for carrying out detailed chemical and microscopic examinations.

Some relaxation of physical and chemical standards, but not of bacteriological standards, recommended by the American Public Health Association may be allowed in the case of water supplies for communities of less than 50,000.

In the case of supplies to temporary fairs and festivals, we suggest rigorous and continuous chlorination of water from surface sources so as to leave at least 0·3 parts per million of residual chlorine. A portable purification plant on a trailer will be useful. Even if filtration is not carried out, at least effective disinfection should be carried out in such cases. In the case of satisfactory rural water supplies from dispersed sources, at least 75% of samples collected and examined may be expected to have an M.P.N. of less than 24 Coliform organisms per 100 c.c. However, more reliance should be placed upon methods of preventing contamination than upon disinfection. Ground water is preferable as it carries less risk of contamination than surface water. A sanitary inspection is more valuable than a stray bacteriological finding. Sanitary protection of wells, sealing of their taps and provision of pumps for raising the ground water untouched by hand should be adopted.

41. Clear water reservoirs and service reservoirs in water supplies should not be accessible for contamination. We would not have mentioned this if we had not noticed examples where this fundamental principle was not observed.

The capacity of service reservoirs should be designed in relation to the rates of supply and draw-off and with due consideration of the possibilities of fire demands arising when the reservoirs are only partially filled.

Water may be distributed through street stand-posts in pilgrim centres, fairs and festivals, in small water supplies to communities of less than 5,000, and to the poorer sections of the community. The stand-posts should be provided at the rate of one for 80 to 150 users. In course of time, as house connections develop, the number of street stand-posts should be reduced.

Where street stand-posts are used, we recommend the use of closed street tanks and waste prevention devices which do not involve much muscular strain.

Even in cases where water is supplied only through street stand-posts, the mains should be designed with a carrying capacity adequate for giving house connections in future.

43. The risk of inlets to water tanks in houses and public cattle watering troughs getting submerged and allowing back syphonage should be eliminated completely by providing overflows below the level of the inlets, even when they are fitted with ball valves.

44. Water supplies to large consumers should be metered and charged for. A tap rate may be introduced for small consumers, although it is not so fair a system as metering.

45. Water works accounts should be separated from other municipal accounts and a sinking fund should be created out of water works revenue for replacements and to pay off loans, etc.

46. A system of sampling and examination of water should be designed and followed for every water works according to its size and importance, so that the efficiency of treatment may be watched and a regular supply of bacteriologically safe water may be ensured at all times at all points of the distribution system.

47. Complete statistics should be maintained in every water works regarding quantity of water supplied, quality of water, materials used, cost of operation, revenue, etc., These should be published.

E. Materials required

48. The greatest handicap to the construction and maintenance of water works today is the lack of materials. Cast iron pipes, specials and valves galvanised iron pipes, pumping machinery, cement, bricks, steel and chemicals (such as alum and chlorine) are all in short supply.

49. About 70 to 80% of the cost of a water supply goes into pipes. These are particularly unobtainable. There are only two pipe factories in India for manufacturing cast iron pipes, in addition to one small pipe factory at Tatanagar. The Bhadravathi pipe factory has a total capacity of only 7000-8000 tons per annum and its entire output is taken up by the Mysore State for its own needs. Its output is booked for some years. The Isco Stanton pipe factory at Kulti manufactures cast iron spun pipes up to 12" inches in diameter. It manufactures larger sizes of straights and all kinds of specials by sand-moulding. Its total capacity of 6,000 tons per month is split amongst cast iron railway sleepers, sugar rolls, and pipes and specials. Actually the factory is producing only 2,000 tons of cast iron pipes and specials a month. We understand that there is a lack of balance between pipes and specials that

orders for special specials are unduly large, that the highest priorities, have been given to the Sindhri Fertiliser Project and the Delhi water supply, and that even articles manufactured cannot be cleared from the yards quickly enough owing to lack of transport facilities for customers. On the other hand, there are water supplies which have been completed for over a year but cannot be put into commission for want of one to five specials.

50. This is a most unsatisfactory position. New water supplies cannot be built according to any plan if we depend on a single factory for supply of cast iron pipes, and that too of small capacity. We cannot and should not import cast iron pipes from abroad owing to the urgent need for conserving foreign exchange for other purposes.

51. Our short-term plans envisage an expenditure of about Rs. 15 crores a year for five years on water supplies. At least Rs. 8 to 10 crores a year will be spent on cast iron pipes, and we need a minimum of about 150,000 tons of these pipes per annum. This demand will be kept up over a number of years. The present output is only 24,000 tons a year. Government should take immediate steps to put up cast iron pipe factories of a capacity of 12000–15000 tons per month. We understand that this can be done with a capital outlay of about Rs. 2 crores and within a period of about 18 months.

52. The capital expenditure will be fully covered by the value of the output in two to three years. This is a Key industry, and we urge most emphatically that Government should take steps immediately to do this within two years.

53. The larger water works will require steel pipes. Even smaller water works may use steel pipes on account of economy and ease of transport. About 40,000 tons of steel pipes per annum can be consumed on water supplies. We recommend that the production of steel sheets and manufacture of steel pipes should be promoted by Government immediately on this basis.

54. Galvanised iron and wrought-iron tubes are not manufactured in India. They are practically unobtainable to the public, and obtainable only in limited quantities to Government departments, industries, etc., after protracted delays. These are essential for rural water supplies from wells and tubes wells, and equally so for house connections in urban supplies. If our short-term programme is carried out, it will result in a consumer demand of the Value of about Rs. 1·5 crores per annum of galvanised iron and wrought iron tubes. A tube mill of a capacity about 15,000–20,000 tons per annum will be necessary and we would urge that this should also be arranged by Government within the next two years.

55. Government should also facilitate the import of the larger sizes of pumps and motors for water supplies. Smaller size pumps, diesel engines and motors are being manufactured in India. If their output is increased, it will be helpful.

56. The production of chemicals used in water purification, particularly chlorine and alum, should be increased. We envisage that India can consume ultimately about 4,500 tons of chlorine per annum on water supplies alone. She will consume about 800 tons of chlorine per annum on water supplies when the short-term plan proposed by us is carried out. The present consumption

on water supplies is probably about 300 tons per annum. Chlorine is an important chemical, used for general public health work, for bleaching in textiles and paper manufacture and for the manufacture of D.D.T. The production of chlorine will therefore have to be stepped up immediately taking into account all these requirements. Data about present production are kept somewhat secret by vested interest. One of the leading chlorine manufacturers was non-co-operative when we wished to inspect his factory. This is unfortunate. We would urge Government to organise and encourage increase of production of chlorine in the country and bring down its price to levels more in consonance with those prevailing in other countries so that the disinfection of public water supplies may be carried out cheaply and efficiently. We understand that the annual production of alum is only about 6,000 to 7,000 tons in India. There was a serious shortage of this important chemical during the war. It is probable that the demand for this chemical will be about 12,000 tons to 15,000 tons per annum when our short-term plan is implemented. Increased production of alum should also be organised by Government.

57. Many other chemicals may be required for water supplies, such as ferrous sulphate, ammonium sulphate or chloride, zeolite, lime, activated charcoal, copper sulphate, etc.

58. Specifications should be standardised as far as possible for the supply of chemicals for public water supplies.

59. Though we have placed the section on materials after plans, the supply of materials should be ensured before undertaking execution of plans.

F. Personnel and organisation

60. The implementation of the short-term programme outlined by us involves the expenditure of about Rs. 15 crores a year on new works, and the periodical inspection of existing water supplies is also essential. This calls for a strong organisation in the Health Ministry of each province to undertake investigation, design construction, maintenance and inspection. For reasons already stated, we are of opinion that the senior officers engaged in this work should be specially trained unless they have sufficient experience in public health engineering.

61. There should be a Chief Public Health Engineer for each province, qualified by training and experience for his special duties, with sufficient staff at headquarters to enable him to discharge his advisory, executive and research functions. He should have a laboratory and funds for experimentation and promotion of research, tools and plant and staff for investigations. He should also have a wing equipped for organising water supplies to temporary gatherings of people at short notice.

62. The Chief Public Health Engineer should be *ex-officio* Secretary to the Water and Drainage Board, if it is constituted as recommended by the Health Survey and Development Committee.

63. The Chief Public Engineer should initiate and control the design construction and operation of all public water supplies in the province. He should give technical assistance and advice on water supply problems free of charge or on a nominal fee to local bodies. If he finds that a local body other

than an autonomous corporation is unable to carry out his suggestions for improvements or replacement of plant or procedures in water supplies, he should have the power to certify the work as essential, have it carried out by his own staff and recover the cost from the local body concerned.

64. The Chief Public Health Engineer may permit the design and construction of public water supplies by consulting engineers and practising engineers subject to his approval. This will eventually relieve him of avoidable strain on his organisation.

65. There should be a sufficient number of executive public health engineers in the field to supervise the construction programme undertaken.

66. We have recommended that the service of Municipal Engineers should be provincialised and placed under the Chief Public Health Engineer. Their emoluments and privileges should be at least on a par with other engineering services in the Public Works Department and their services should be placed by the Chief Public Health Engineer at the disposal of Municipalities exactly as health officers are placed at the disposal of municipalities by the Director of Health Services. By this procedure the Chief Public Health Engineer will be able to ensure better standards in the maintenance of water works, etc., and greater technical co-operation from municipal engineers. They will also be able to widen their horizon when they are subject to transfers all over a province.

67. The existing practice of having a mechanical expert on the Chief Public Health Engineer's staff may be discontinued if the standard of operators rises. At present his prospects are in a sort of blind alley. We have no objection to the continuation of this arrangement in certain provinces if desired, but feel that detailed advice on pumping machinery and electrical equipment can be obtained by consulting the experts in other departments of Government when necessary.

68. Water works operators should be trained to realise their responsibilities and improve their technical knowledge. Standardisation of their training should be effected gradually. The operator should have a basic knowledge of engineering and should be familiar with the techniques of examination of water, though he may be assisted by a technician for carrying out routine examinations in the laboratory.

G. Finance

69. We have already indicated in section 'C' our recommendations for sharing the capital cost of water supplies of various categories between the Centre, the provinces and local bodies.

70. Whatever be the funds actually made available for water supplies, the Provincial Government should provide a strong technical organisation to ensure that the money provided is fully and well spent. The cost of the public health engineering department (including the municipal engineers) should be borne by the Provincial budget.

71. The capital cost of water supplies in rural areas should be met entirely by the Provincial Governments. The cost and organisation for the maintenance of these supplies should also be provided by them through their public health

engineering departments. It is not satisfactory merely to make a grant for maintenance of water supplies to local bodies, as they have no suitable organisation. If the local board engineer is made answerable to the Chief Public Health Engineer, he may be charged with the duty of maintaining rural water supplies.

72. The capital cost of municipal water supplies should, in principle, be borne at least partly by the municipality. Their share may be fixed as half. The cost of maintenance should be borne entirely by municipalities. Their share of the capital cost may be advanced as a loan by Government and recovered over a long term of years.

73. The Chief Public Health Engineer of every province should have a sum of at least Rs. 5,000/- and as much more as he may require, placed at his disposal every year for experimentation and research to be conducted in his laboratories or in collaboration with other workers on any water supply problem.

CHAPTER VI

MEASURES FOR THE HYGIENIC COLLECTION AND DISPOSAL OF COMMUNITY WASTES

The introduction of protected water supplies alone will not be sufficient for achieving control over gastro-intestinal diseases. Human excreta provides the germs of such diseases and, so long as it lies exposed to flies which can either breed in or food on it, food and drink can be contaminated through flies. The pollution of the soil by human excreta can also be a very great contributory factor in helminthic infections. It is therefore essential to supplement protected water supplies by measures to ensure the collection and disposal of human excreta without polluting the soil or exposure to flies. The nature of these measures will vary with the size and the nature of the community. A higher degree of perfection will be necessary with greater density of population. The " insanitary conditions" that are found in slums, blighted areas, labour colonies and small municipalities refer largely to the total or partial neglect of such measures. The standards of hygiene of the individual and the community are reflected largely in this state of neglect. A clean and healthy environment should not contain heaps of refuse and excreta or pools of sewage.

2. The measures that we have suggested in this chapter fall under six categories, namely :—

(*a*) Sewerage.

(*b*) Sullage drains and open drains.

(*c*) Sewage disposal.

(*d*) Public cleansing.

(*e*) Disposal of refuse.

(*f*) Collection and disposal of excreta in unsewered areas.

The materials and the personnel and organisation required in this connection have also been discussed.

A. Sewerage

3. The removal of human excreta without pollution of soil and water and exposure to flies can be most satisfactorily acomplished by conveying it in a current of water through closed impervious sewers. We consider that as a long-term programme every municipality and industrial colony should be served by " sanitary sewers".

4. Sewers have been laid only in 23 cities out of the 48 having population of over 100,000 and in about 12 other towns in India. Even these cities and towns are only partially sewered. In most sewered towns and cities the proportion of premises not connected to sewers and served by conservancy varies from 33 to 75% of the total premises. The total population nominally served by sewerage is not more than 10 millions (by 1941 census) out of the 320 millions in the country. Considering the fact that the first sewers were laid in Calcutta in 1867, the progress has been very slow.

5. As a short-term plan, to be achieved in five to ten years, we suggest the following modest programme in the order of priority given below :

(1) Urgent improvements to existing installations and prevailing methods of disposal in sewered cities to cope with overload and wear and tear.

(2) Extension of sewerage to new housing developments and extensions of city limits in cities where there is already a sewerage system.

(3) Laying of sewers in all permanent pilgrim centres.

(4) Laying of sewers following the introduction of satisfactory protected water supply in all unsewered cities either with a population of over 1,00,000 or with a high density of population.

(5) Laying of sewers in predominantly industrial towns.

(6) More complete utilisation of sewers in sewered areas.

6. The total outlay required for the above programme may be about Rs. 15 crores, which can be spread over five to ten years and shared equally between the municipalities and Povincial Governments subject to the remarks made in paragraph 9 below in regard to permanent pilgrim centres.

7. As municipalities derive no revenue from seweres, they may be unwilling and unable to come forward with proposals ; we recommend that Provincial Governments should, on their own initiative, prepare the schemes and have them carried out. The share of expenditure chargeable to the municipality may perhaps be financed out of the proceeds of the entertainment tax collected within the municipality. We have no data on this matter, and are only making a suggestion. The legal and financial position may be examined to facilitate a way of meeting the capital expenditure.

8. The laying of sewers in permanent pilgrim centres will be an important contribution towards the control of epidemics in the country. We were pleased to note what has been done at Hardwar in this respect.

9. We recommend that the cost of laying sewers in all permanent pilgrim centres should be shared equally between the Central Government and the Provincial Government concerned. The share of the Provincial Government may

be met out of the funds of religious endowment boards or other interests that may benefit by improved sanitation.

10. With regard to the more complete utilisation of sewers in existing sewered towns, we recommend that Provincial Governments should press municipalities to accelerate progress. If a house-holder does not connect his premises within a year from the date of service of notice, the municipality should carry out the work by a system of subvention through its own agency without waiting further and recover the cost with rates from him. We recommend that Provincial Governments should advance loans every year to municipalities for this specific purpose and ensure that at least 90% of the premises are connected within the next 10 years.

11. In many municipalities there is a rule requiring the owner of private premises to connect his privies to municipal sewers if they are within 100 feet from the limit of his property. However, if the "premises" consist of a large colony of houses belonging to a co-operative housing society, or a factory, or a public or private body, there is a deadlock because the cost of laying a long sewer through the colony becomes too high. The definition of private premises should be changed, and municipalities should be obliged to lay sewers to within 100 feet of the actual buildings in bustees, public housing estates, labour housing colonies, co-operative housing estates, etc. where 20 or more houses in a block are to be served. This is essential in their own interests. For even if a municipality is sewered but if the premises are not connected, the municipality is obliged to maintain a large number of sweepers for conservancy and pay them. If they go on strike, the municipality gets into trouble and public health is affected. It is therefore in the interest of the municipality to lay its sewers as near the actual houses as possible, even through private roads, and then compel the owner to connect up.

12. The installing now sewerage systems, we would strongly urge the overwhelming importance of —

(*a*) selecting the outfall point first and then adhering to it,

(*b*) not allowing any town improvement or master plans to be adopted which will involve the shifting of the outfall point once selected by allowing the town to grow on that side,

(*c*) starting from the outfall end, so that the sewers may be utilised from the beginning and the people need not wait till the entire scheme is completed,

(*d*) laying not only main sewers but branch sewers also in areas where houses have already sprung up,

(*e*) planning the project in progressive stages so that the investment may yield benefits from the beginning, and

(*f*) deciding upon some form of treatment or disposal of sewage before commencing sewerage, and not after completing it.

13. These are only elementary principles applicable to many other engineering undertakings. Yet we find these principles defied in sewerage projects. Nagpur drainage is an instance where sewers have been laid, in certain parts of

the city, starting from nowhere and ending nowhere, with no benefit to anybody for all the heavy capital investment already incurred. The master plans encircle the city in all directions. The plans could have been confined to expansion on sides other than that of the outfall already built. Although we have mentioned Nagpur it is by no means singular. Sewerage and water supply are not sufficiently co-ordinated into town planning and improvements in other cities too.

14. The primary function of sewerage is the safe collection of excreta without exposure to flies and without pollution of soil and water. This cannot be fulfilled adequately if a large number of pail depots are built as an integral part of a sewerage system. Pail depots may be tolerated temporarily, but not for more than 10 years from the date of completion of sewerage.

15. Storm water or drainage should be accorded a lower priority than sanitary sewerage from the public health point of view.

16. It follows that sewers for carrying excreta alone on the separate system may be preferable in many places. However, in flat deltaic areas, subject to heavy monsoon rains, it may be an advantage to install sewers on the combined system.

17. Sewerage should not be introduced without ensuring an adequate water supply. An intermittent water supply is likely to lead to deposition of sewage solids in sewers during the hours of closure of supply.

18. Sewer systems should be designed, like water supply, for service for one generation (30 years). In separate systems the carrying capacity of sewers should be designed on the basis of population, the percentage of water supply that may reach sewers (multiplied by a factor as in the case of water supplies to give the peak rate of flow), an allowance for unauthorised admission of rain water from roofs and yards, and infiltration of groundwater through imperfect joints. In the case of combined systems, the carrying capacity should be fixed on the-basis of run-off and time of concentration. The adoption of the Rational method would result in more satisfactory service than is now given by sewers. It is not uncommon to find the heads of storm sewers surharged and streets flooded, while the outfall sewers do not flow full. Such conditions will be reduced if more time is spent on designing sewers by the more laborious Rational method and the requisite data is collected beforehand.

19. The adoption of fairly uniform standards of design and construction is necessary in sewerage as much as in water supply.

20. We recommend a higher self-cleansing velocity for a combined sewers than for separat sewers. Whatever values we may suggest, there may be circumstances in which they cannot be attained. In all such situations, flushing devices should be provided. We recommend 2·0 feet per second as the minimum velocity for separate sewers and 2·5 feet per second for combined sewers when the designed average discharge. In addition, we recommend good ventilation particularly for concrete sewers which are likely to disintegrate in the presence of carbon dioxide.

21. There is room for economy in sewer design and construction. This should be fully availed of. The avoidance of elaborate foundations for sewers

in good soil is a case in point. Curious practices, like the construction of "effluent sewers" that we noticed at Patna, should be discouraged. The effluent sewers are sewers to carry effluents from large regional septic tanks holding sullage and silt from open drains.

B. Sullage drains and open drains

22. Many small municipalities, union boards and panchayats have spent money on the construction of open drains for sullage and storm water. These drains are in bits, often unconnected, starting and ending nowhere. Sullage is theoretically the liquid waste from a house, excluding nightsoil and urine, but in practice these drains are used as shallow trench latrines. The areas in which these drains have been built are full of houses without latrines.

23. Further sullage drains do not get sufficient liquid matter to flow down without deposition of solids. Most sullage drains are at least six inches in diameter and have to be laid more or less on the gradient of the street. Small towns have no water supply ; hence the amount of liquid waste coming out of a house is less then three gallons per head per day. This cannot flow down six inch drain unless pushed or flushed out. As the drain is at the level of the road, road dust, silt, leaves, refuse, etc., fall into it, and the flow of sullage is further obstructed.

24. The net result is that in dry weather the sullage drain in just one long trench full of flies and filth, and produces foul odour. It is broken in many places. At the end of the drain, the sullage stagnates in an offensive pool and breeds mosquitoes capable of transmitting filaria and dangue fever.

25. During rains, the open drain is flushed by the storm water, but immediately afterwards the drain is silted up. Till the silt is removed the sullage soaks in it.

26. We are, therefore, against the indiscriminate construction of sullage drains. They often add to insanitary conditions instead of improving them. They ought not to be built without first ensuring that the houses served by them have sanitary latrines ; otherwise these drains are likely to be used as latrines and urinals. If a house has some amount of open space, it is better to insist upon the disposal of its sullage on its own grounds in a soakage pit than to let it into the sullage drain. If this done, the open drain will carry mostly storm water and conditions will be less offensive.

27. Even the provision of impervious cess pits and transporting their contents into a barrel on wheels is a lesser evil than sullage drains in areas not served by latrines.

28. There are places in every town where houses have been built very close, with little or no open space, and open drains are necessary to carry away foul water. In such cases, the whole system of open drains should be well planned, with the best available gradients, an outfall and a method of disposal. In addition, the daily flushing and cleansing of open drains should be properly organised with sufficient staff, water carts, brooms, etc.

C. Sewage disposal

29. The removal of sewage or sullage up to the limit of private property or town limits is not sufficient by itself. Arrangements for disposal of sewage

without risk to public health should be an integral part of every sewerage or drainage system. The method of disposal should, at least tentatively, be settled and approved by the public health engineer before money is spent on drains and sewers. In deciding about the disposal, the least expensive method should be chosen, provided it is free from hazards to public health, not otherwise.

30. We cannot say that sufficient attention has been given to the technical aspects and public health aspects of disposal in all sewage works. There are cities like Kanpur and Banaras which do not treat sewage and throw it into the Ganges with impunity even in dry weather. There are a few cities which have adopted septic tanks for very large populations and produce foul thick effluents. Some cities have good sewage farms, while others have badly managed farms or farms too small for requirments. There are cities like Patna having a medley of systems in certain parts, ranging from activated sludge to a sick farm and septic tanks, and no sewers in the major part of the town. There are cities like Bombay and Madras which have at present unsatisfactory sea outfalls causing nuisance on the shore. Bombay has a full-treatment plant for a small part of her sewage. Calcutta has primary sedimentation tanks in which the mechanical equipment is not well maintained. Delhi has a Simplex plant that works fairly well, but has been overloaded and needs enlargement.

31. We are of opinion that where or when it is possible to get sufficient dilution, as in the sea, and other conditions are favourable, sewage may be disposed of in a large body of water after grit removal and screening to remove grosser practicles. However, the outfall should be designed to dispose the sewage into deep water at many points, so that it may not be carried back to the shore- When the dilution is insufficient, as it is in many rivers, the treatment of sewage should be carried to further stages. How far it should be carried depends on the capacity of the body of water to carry on aeration and self-purification. We will deal with this question again in the chapter on stream pollution. It is not advisable to fix a universal standard for the B. O. D. (biochemical oxygen demand) of the sewage effluent for discharge into a body of water, without an appraisal of the nature of the receiving body of water and the interests that will be affected. We recommend that this should be left for the present to the Chief Public Health Engineer of the Provincial Government or the consulting Public Health Engineer of the Central Government (proposed on Chapter XVII paragraph 6) to decide after taking all relevant conditions into account. An unnecessarily high standard may be attainable by expensive treatment, but the extra cost may not be justifiable.

32. In the case of inland towns, if suffi cient and suitable land is avilable sewage may be applied to the land after grit removal, screening, and a short period of settlement if the soil is not very porous. We can suggest only broad limits (of an acre for 100 to 300 persons) for the land required for farming. Much depends on the texture and porosity of the soil. If subsoil drainage is adopted the land may be reduced, as it then acts somewhat l ke a trickling filter.

33. Nothing which is likely to come in contact with sewage and likely to be consumed raw should be grown on a sewage farm. We learn that research on the depth of penetration of sewage bacteria in the skins of certain vegetables is being planned, but the conclusions, can be adopted only after making due

allowance for the "factor of safety" or human ignorance. We recommend taking no risks with public health in sewage farming. Fodder grass and potatoes seem to be most paying crops. Fruit trees, whose fruits are high above the ground, can be grown. But sugar-cane, coriander, cucumber, tomato, carrot, lettuce, beet, radish, sweet potato, sweet pea, onion, green chillies, water melon, turnip, cabbage, pineapple, etc., should not be grown on sewage farms as they are often consumed without boiling.

34. Sewage farms should be managed under the direction of a competent agricultural expert. The amount of nitrogen applied per acre per annum in sewage farms is five to seven times what one would apply asartificial fertiliser. If additional water is available, sewage may be diluted with it and applied to land to make a more economical use of nitrogen. This is being done at Poona and Hyderabad.

35. Preliminary treatment and sewage farming in dry weather and discharge of excess sewage into a flooded river during rainy days may be feasible in many places. If farming has to be suspended and dilution in the river is insufficient for discharging sewage at the time, the sewage should be discharged only after chlorination.

36. It is possible to practise pisciculture in sewage under certain circumstances, if the sewage can be held in a series of shallow ponds for three or four weeks. Complete treatment of sewage may be necessary in certain towns or portions of towns for public health reasons, when land and water disposal are not feasible without restrictions.

37. Wherever screening, grit removal and sedimentation of sewage are practised, the hygienic disposal of solids removed sould be arranged for, as they contain the bulk of the offensive matter. Steps should be taken to ensure that grit contains not more than 10 %—15% organic matter. Screenings should be buried or burnt or shrodded and put back into sewage. Sludge should be digested, so as to make it innocuous and easier to dewater and handle even though its agricultural value may be slightly reduced. The bye-product of sludge digestion, methane is a valuable national asset and should be utilised, wherever possible. It can be used for heating or in lieu of petrol.

38. Among more complete treatment plants, we have seen very few trickling filters and their various modifications such as bio-filters. These are sturdy processes of proved value, and we command them for adoption in small plants. It should not be difficult to manufacture nozzles for dosing trickling filters in our country.

39. We have seen a fair number of "Simplex" activated sludge plants, which are on the whole satisfactory in their performance. But other variations of activated sludge treatment, such as diffused air plants, are rarely seen. We are inclined to think that operators do not take sufficient care of the mechanical equipment in such plants and thus bring discredit to the processes through their own negligence. The few sludge digestion tanks built in this country either are not functioning or are operating at low efficiency, mainly because of lack of interest on the part of engineers and operators.

40. Many engineers in this country believe that septic tank treatment is sufficient even for large quantities of sewage. This is not correct. Our considered opinion is that the use of septic tanks for large communities should be deprecated. Sedimentation and separate digestion of sludge in closed or open tanks is necessary for communities of over 5,000 and preferably even for smaller communities.

41. No two-storeyed tanks have been built in India, for some reasons that we cannot understand. These tanks have been found to given very good service for populations of 1,000 to 10,000 in other countries.

42. Vacuum filtration of sludge and other recent technical developments in the treatment of sewage have not yet reached our country.

43. There are sewage laboratories only at Delhi, Bombay, Poona, Hyderabad, Jamshedpur and Patna. The one at Bombay is particularly good. Similar, if not better-equipped, laboratories should be built at evey sewage treatment plant for efficient plant control, and trained technicias should be appointed to run them. Analytical and operational statistics should be collected more systematically and thoroughly so that experiences may be pooled and exchanged, and better techniques in sewage treatment may be evolved.

44. The time lag between design and completion of works is much longer for sewerage and sewage treatment plants than for water supplies and treatment plants. This should be allowed for in designing works for service for a certain number of years. When a town is being newly sewered, it may take some years, perhaps decades, to be connected up. The sewers should be large enough for the design population, but it is better to design the treatment works flexible enough for enlargement in stages in order to cope with increases in volume of sewage, instead of building too large a plant in the beginning. However, the snag lies in finding the money and in getting the enlargement done when it is due. This difficulty has been so common that engineers prefer to spend the money all at once when it is available.

D. Public cleansing

45. Refuse should be collected and disposed of in a manner free from hazards to public health. The hazards arise from fly breeding and rat breeding. Other considerations, such as utilisation of refuse for composting and making of money, should be subordinated to the over-riding necessity of incurring no risks of fly and rat breeding in the handling and disposal of refuse. We have been obliged to affirm this first principle in public health engineering because we find that it is not being observed due to the misguided enthusiasm of people who should be considered laymen in this matter however eminent they may be in their own particular fields. "Wealth from Waste" is not to be produced at the expense of health.

46. Government should insist that even the smallest local authority or board should perform this primary function satisfactorily.

47. Some do not perform it at all. There are municipalities in the United Provinces in which refuse and night soil are allowed to be mixed together during collection.

48. House-to -house collection is undertaken only in selected wards in almost all Indian towns. The majority of citizens are expected to make their own arrangements to collect domestic refuse and deposit it in the street dustbin, or in huge refuse depots—like pail depots. The municipal collection service is generally limited to removal of refuse from streets, street dustbins and refuse depots, by an old assortment of vehicles, to some lowlying ground for indiscriminate dumping.

49. The refuse collection service is under the control of the Health Officer and his sanitary inspectors in almost all municipalities except Calcutta.

50. Public cleansing is a service that can succeed only with the active interest and co-operation of the citizen. If he is not really interested in keeping his pr mises free from accumulations of refuse, the town cannot be clean.

51. However, there is a limit to what should be expected of him. He should not be expected to carry his household refuse along a street and deposit it in the bin or " dalao", and he does not do it. He employs private scavengers and sweepers, who mix up nightsoil and refuse, throw it on the streets or do anything else so long as their master's house is clean. They are not paid by the municipality and are not under the control of the Health Officer.

52. This " customary sweeper" service should be abolished, and local bodies should arrange for collection of refuse from houses, not only from public dust bins and " dalaos".

53. When this is done, every householder should be compelled to put his refuse into a suitable, sturdy bin with a cover and keep it on his pr mises in a place which is readily accessible to the municipal sweepers. The will to effect this overdue reform is lacking at present even in big municipalities. We suggest that the Provincial Ministry of Local Self Government should compel municipalities to effect this reform within five to ten years at the most. When this is done, the number of public dust bins can be reduced and stre ts will be cleaner requiring less water for washing. The urban citizens can well afford to buy and maintain his own domestic refuse bin, except in the case of houses occupied by very poor people. Municipalities should draw up standard specification for closed dust bins of capacities of four, six and eight gallons and arrange to make them available for sale. Even in the case of private housing estates, municipalities should not be allowed to omit collection on the ground that the whole premises are a single property for taxation purposes. The municipal sweeper should be required to collect refuse from each house of a group of houses on a single estate when private dust bins are provided.

54. Municipalities should also be required to remove refuse from bustee areas and slum areas. In such places a public refuse bin may be provided.

55. It is difficult to design and maintain a really satisfactory public refuse bin. If it is large enough to hold the refuse, it is too unwieldly to be lifted, emptied and cleaned. If it is small, the refuse spills and is scattered around it. If it is to be rolled out, the absence of a bottom and a top results in dirty pavements swarming with flies. We recommend that public dust bins should be reduced to the smallest number possible simultaneously with the provision of private bins and that public bins should be kept clean. Eventually, public bins

should be used only in markets and in colonies exclusively occupied by very poor people.

56. The vehicles employed for transporting refuse have to be designed suitably. An open lorry full of refuse speeding on a road is a public menace. The refuse is scattered from such vehicles by the wind. Expert advice should be taken by municipalities from a public health engineer before placing orders for refuse vehicles, as they should have sufficient capacity, cover, suitable height for loading, facilities for tipping or unloading with ease, etc. We are not in a position to make any recommendations about mechanisation of transport. If roads are wide and have easy curves, and houses are scattered, mechanical tranport may be economical for house-to-house collection. Lorries will be always better for bulk transport of refuse to the place of disposal. There are many old towns with narrow and tortuous streets in which lorries cannot be used freely. In such places slower, smaller and more primitive forms of transport may have to be employed. Municipalities may have to buy and maintain horses, donkeys, bullocks and buffaloes for such purposes. There are various difficulties in such an arrangement.

57. Every municipality with a population of over 1,00,000 should have a well-equipped workshop in which municipal transport vehicles can be carried, and machinery belonging to water works and sewage works can also be repaired. Such workshops should be run on a commercial basis. They should under take repairs of transport vehicles of smaller municipalities, panchayat boards, etc., if required.

E. Disposal of refuse

58. The disposal of refuse should be carried out without any public health hazards. The method now followed in most municipalities is indiscriminate dumping. This should be replaceed by controlled tipping wherever possible. The recovery of articles of value from refuse by private persons should be controlled, and steps should be taken to ensure that the salvaged property is allowed to reach the market only after disinfection. Where sufficient water is available and other circumstances are favourable, we suggest farming on land used for controlled tipping. Calcutta has made use of such opportunities and leased the rights of raising vegetables on the refuse dump to a contractor who seems to be doing very well indeed.

59. We recommend incineration of refuse in crowded cities where there are no opportunities for integrating refuse disposal with land reclamation scheme.

60. The incinerators should be well designed and cause no nuisance in the neighbourhood. The higher cost of running and incinerator can be offset by lower cost of transport of refuse.

61. Composting is no doubt a good method of integrated disposal of refuse and human excreta. If carried out under proper supervision. It will help in food production. However, we have seen few places where composting is carried out without fly production, and fewer places where the compost finds a ready market. The actual officers in charge of composting in municipalities are not as enthusiastic as the propagandists are. A part of the failure of composting is due to poor management.

62. We do not advocate composting for municipalities with a population of over 1,00,000. They ought to install under ground sewers to transport human excreta, as this is safer in every respect than manual removal of nightsoil from latrines and is not likely to be affected so seriously by strikes of sweepers. If such municipalities are allowed to compost night-soil, they will develop a complacency about insanitation and put off sewerage forever. A city like Patna is carrying on composting instead of laying sewers. We recommend that composting should not be permitted in cities of over 1,00,000.

63. When these cities are sewered, the nitrogen in the waste can be conserved for agricultural use by sewage farming wherever feasible.

64. As regards smaller muni ipalities, we would recommend composting of nightsoil on a site at least half a mile away from the municipal limits on the leeward side under good supervision. It will be redundant to trench night-soil, if composting is carried on.

65. We have seen compost enthusiasts proposing to encourage composting in private compounds in municipal areas. This will be positively dangerous. There will be hundreds of ill-made compost heaps breeding flies. Any such move should be firmly resisted.

66. In villages and other places where there is no organised refuse or night-soil collection we donot see how composting can be carried out efficiently. Only cattle dung will be available. That can be dumped into a manure pit in each compound and covered with straw and ash. Eventually, it can be used as manure every year or half-year. We strongly recommend the construction of such manure pits for cattle dung, straw and leaves, but not the composting of human excreta in rural areas.

67. We have come across a suggestion that villagers should put up public trench latrines, defaecate in them and cover the excreta with refuse before leaving. These are the "Wardha" latrines, said to be designed to produce compost for village use. Knowing the frailties of ordinary human beings and the difficulty of collecting and bringing refuse to a public latrine in a village, we have to state in all humility that the scheme is utterly impracticable in a society not composed of angels.

68. Under these limitations, and after paying due regard to public health, the amount of compost that can be produced will be rather small. It should be remembered that the houses are not provided with satisfactory latrines in all small municipalities. Urine which containing a lot of the nitrogen in human excreta is rarely collected in the pails of latrines. The bulk of it is lost and hardly 10% of it is collected by the sweepers. Under the prevailing system of collecting refuse from public refuse bins only, a considerable portion of domestic refuse escapes collection. Street sweepings from the inferior road surfaces of small municipalities consist partly of road dust. In these circumstances, we consider that not more than 3 grams of nitrogen per capita per day (2·4 lbs. per capita per annum) can be conserved by composting. About 55 million people live in towns with populations of 5,00 to 1,00,000 in India today. They are the only group suitable for compost production. Under the most favourable conditions not more than 59,000 tons of nitrogen per annum can be conserved by composting their excreta. The standards of municipal refuse collection and night-soil

collection should be raised very considerably and arrangements for supervising the manufacture and marketing of compost should be perfected before we can reach this target of production. It is not a small target, but it is not so impressive either. We are therefore of opinion that the value and potentialities of composting of human excreta have been overrated, while the accompanying dangers to public health have been overlooked.

F. Collection and disposal of excreta in unsewered areas

69. About 3% of the total population in India is now served by sewers. When the short-term plans outlined by us are carried out, about 5·8% may be served. In the sewered areas, water closets only should be permitted. We have already detailed our recommendations for promoting connections to sewers and eliminating service latrines in sewered towns.

70. In unsewered towns, service latrines have been built in many of the houses. They are not very satisfactory. The pails are too small and difficult to clean. The liquid excreta and washings are rarely collected as they ought to be. They run into the so-called sullage drain or stagnate behind the latrines, which fulfil neither sanitary requirements nor the requirements for composting of human excreta. Health authorities can exercise stricter sanitary control and raise the standard of these latrines. But if they do, they will have to increase the number of sweepers. The attitude of many municipal administrations is not to give better service at more expense but to reduce the number of sweepers. An excutive officer of municipality told us : " Fortunately, few people have latrines here ". Though he was not discreet, we can understand why he said so. It is difficult to recruit and maintain a class of labourers for this demeaning service and keep them contented. The forces of social awakening are operating to abolish this class and elevate them to the same status as other labourers.

71. The removal and disposal of excreta from service latrines is least satisfactory in union boards. They often have no trenching ground and, even if they have one, it is operated in a most insanitary manner. The sanitary defects should be rectified.

72. We therefore recommend the construction of latrines which require no service and in which the excreta can be disposed of at the site of the latrine in a hygienic manner. The best type is a latrine in which solid and liquid excreta can be washed down into a domestic septic tank. If there is sufficient land, the effluent from the septic tank should be used in the soil for a kitchen garden. In house consisting of 10 numbers, not provided with a liberal water supply, the volume of effluent coming from a septic tank will not exceed 50 gallons in a day. This quantity can be absorbed in about 100 to 600 square feet of average soil (allowing a large factory of safety) if the subsoil water is not too high and if the plot is divided into two or three sections and used in rotation every year. It is therefore necessary in unsewered towns and villages to provide a minimum of 700 square feet (or 70 square feet per head) of open ground for each house (allowing an extra 100 square feet for other purposes). The house holders should be encouraged to build septic tanks and have the effluent absorbed in their own plots by sub surface percolation or surface irrigation.

73. The septic tanks should be provided with means of desludging and should be desludged regularly. Such decentralised sewage disposal will be helpful from the point of view of sanitation and conservation of the fertilising value of excreta for food production. Wells used for drinking water supply can be rendered safe if they are provided with an impervious lining for a depth of ten feet below ground. The work done recently shows that the risk of subsoil pollution of wells in rural areas is much less than that of pollution above the surface. Health authorities, who have been refusing permission for the construction of septic tanks in non-sewered areas, should change their attitude. When a house-hold is not served by sewers, when the water supply is limited and when septic tank latrines are also prohibited, no latrines are built or an unsatisfactory service latrine is built. The latter is less sanitary and worse from the public health point of view than a septic tank latrine. Blind insistence on a distance of 100 feet from latrines to wells irrespective of the type of latrine and other conditions is devoid of purpose.

74. Even if there is not sufficient land for the absorption of effluent from the domestic septic tank, the discharge of effluent into a municipal sullage drain should be permitted if it is already there. The effluent from the tank is not likely to be worse than the raw urine and faeces which the drain actually carries.

75. Villages present the most difficult problem in the collection and disposal of excreta. 85% of the population lives in villages, but hardly 5% of the houses there have any latrines. The soil is incessantly polluted on a vast scale.

76. Septic tank latrines, water-seal, well latrines, "Hagari" (Mysore type) latrines, borehole latrines and pit privies are suitable types for villages. They require no sweeper service and are reasonably safe and clean within the limitation of low cost and the imperfections of a rural environment. They should be promoted. We are not going into the details of exceptional circumstances where their construction may not be feasible on account of soil texture, subsoil water level, etc. We require millions of them. The problem is how to get them built at least in places where they will be suitable. For obvious reasons, they cannot be built and presented to each house by health departments of Provincial Governments. Only technical service can be given. Inducements can be offered. A few model latrines of each type should be built in each village for educative purposes. But the villager himself should wish for it, should appreciate the use of a latrine, and should be interested in maintaining it in usable condition. Unless this level of education is reached, we cannot expect any appreciable progress in improving the rural environment. When a villager wants a latrine and puts it up, it indicates the attainment of a perceptible higher standard of hygiene. Its value in terms of public Health will be much more than the reduction of gastrointestinal diseases.

77. The Health Survey and Development Committee planned to establish living contact between the health organisation and the villagers through combined curative and peventive service and to educate the villagers to build latrines. The health centres are expected to provide technical assistance in the maintenance of water supplies, construction of latrines and prevention of malaria through the sanitary inspectors and field crew under the direction of public

health engineers. It is a well-conceived plan, but we do not think provinces will implement it. We have seen provincial plans which cut down expenditure by curtailing environmental hygiene services and activities and by retaining only personal medical and health services. We are of opinion that this is incorrect and will be futile.

78. The villagers can be induced to put up latrines in their houses if there is good leadership, backed by an organisation for technical service. Unfortunately the average subordinate Government servant is not capable of this leadership. He has only obeyed orders and thinks of himself as a Government servant rather than as a public servant. Rural panchayats, social service organisations, schools, health centres, etc., are all means of reaching the villager. Every province has been passing legislation for organising rural panchayats. We are of opinion that they have potentialities for improving the rural environment and getting latrines built in rural areas if their activities are regulated and oriented suitably. They may also prove to be only a hunting ground for self-centre opportunists.

79. In rural areas, the aim should be to promote latrines in each house and not public latrines. The latter are not so effective. Collective responsibility often degenerates into irresponsibility : the standard of cleanliness is lower and has to be propped up by a paid sweeper. Public latrines are often badly located. Where water for ablution is not provided, people prefer to go to a tank or river rather than to use a public latrine. The number of seats is often inadequate in the public latrines for industrial workers.

80. Of various types of public latrines, the service latrine is the least satisfactory. A septic tank latrine with arrangements for flushing is better, but it is difficult to get the water for flushing in places where there is no piped water supply. We have seen an arrangement by which a 40-gallon tipping bucket is filled and tipped every day by a sweeper. This wili be satisfactory so long as the sweeper does his duty. The design of satisfactory public septic tank latrines is a matter involving many factors, such as water-supply, flushing, etc. We are of opinion that competent technical advice should be taken in each case.

81. Bore-hole latrines should not be built for use as public latrines and, where already built, should not be used for more than three months. They are cheap and satisfactory as family latrines. They require reboring after a time. Expenditure on public latrines should be limited to the barest requirements in rural sanitation programmes. The education of the individual is far more important than the mere provision of a physiological need.

82. Public latrines should be built at railway stations, bus stands, parks, places of public entertainment, markets, schools and colleges, hostels, dharamsalas, public offices and places of public worship. The number of seats should be on a standardised scale. The number of people to be served mutiplied by the number of houses of their needing it and divided by 200 to 400 is a formula that has been suggested as suitable. It will correspond to a seat for 8 to 16 resident users who will need it all the 24 hours.

83. The provision and maintenance of water supplies in villages and the introduction of D.D.T. spraying for mosquito control can be used as levers for pushing on latrine construction in villages. These are the two services which

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people readily appreciate. Whenever such opportunities occur, they should be fully utilised for making personal contacts with leaders in villages and getting latrines built. Rural sanitation should be integrated with rural water supplies and mosquito control by D.D.T.

84. Our recommendations in this chapter should be read in conjunction with those on housing. We have made definite proposals there that building of a new house in old or new villages should not be allowed unless a latrine is also built. This power should be vested in the rural panchayat board. Government should also make available to the people designs, materials and equipment for putting up latrines. Standard concrete squatting plates can be made and supplied to villagers at cost price. Equipment for putting down borehole latrines should be maintained at every health centre and every sanitary inspector's office in the rural areas. A few model latrines should be built by Government in as many villages as posssible, in the house of the most useful social worker perhaps the school master or the midwife. If it is built in an office, it becomes public property and may not be taken care of unless there is a paid caretaker.

G. Materials

85. As in the case of housing and water supplies, the shortage of materials is a deterrent factor in the implementation of plants for the hygienic collection and disposal of community wastes. It should be overcome by increase of production and better allocation of existing production.

86. Now sewerage schemes have to be shelved because sewer pipes, cement and even bricks are not available. We were surprised to learn that there are only three or four large sources and some small sources of supply of stoneware pipes in India. These are the Raneegunge potteries and Jubbulpore potteries of Messrs Burn & Co. and the Mysore potteries. The total production of pipes in these factories does not exceed 1200 tons per month. It will suffice only for the existing normal demands for new house connections in cities like Bombay Calcutta and Madras. If a drive is made to connect unconnected premises, the production will be found insufficient. If the modest short-term plans that we have recommended for sewering all cities of over 100,000 are to be implemented, at least three more potteries should be built and the total production of stonware pipes and drainage fittings stepped up to at least 3000 tons a month. The production of sanitary fittings, galvanised pipes, etc., should also be ensured to cope with the new demand.

87. In a large sewerage project of the order of Rs. 50 lakhs, about 25% of the cost may be spent on pipes. It will be worthwhile for the engineers in charge of such undertakings to arrange for the manufacture of cement pipes in their own factories. We have no time to go into details of the economic size of such factories, etc., but when Government decides to lay down a policy of sewerage and latrine construction, it will have to step up cement production, increase the output of cement pipes, stoneware pipes, sanitary fittings, galvanised pipes and cast iron pipes for pumping mains. The cement required may be of the order of 40,000 to 50,000 tons per annum for a programme involving expenditure of about Rs. 10 crores per annum on sewerage and sewage disposal, drainage and latrine construction throughout India.

H. Personnel and Organisation

88. Sewage plants need trained personnel for operation. Besides mechanical engineers and electrical engineers for pumping stations, there should be agriculturists for sewage farming and chemists for analysis. Above all there should be a public health engineer to co-ordinate the work of the actual people in charge. Expensive plant requires good maintenance. In the large self-governing Corporations, the drainage department should have a public health engineer at the helm. In municipalities, the municipal engineers should be provincialised and placed uner the Chief Public Health Engineer. They will then be able to maintain their sewage plants up to the required technical standards, uninfluenced by non-technical considerations. As in the case of water supplies, the Chief Public Health Engineer should be authorised to certify a work as essential and have it carried out at the expense of the municipality when he finds that the municipality is not co-operative. However, the necessity for such certification will diminish if the municipal engineers are provincialised.

89. Refuse collection and disposal can be entrusted to the municipal engineer. In our interviews we have found most health officers and Directors of Health Services anxious to divest themselves of this responsibility. The maintenance of transport vehicles and the organisation of labour are the preponderant features of the work and an engineer can do it better than the health officer, provided he has had sufficient training to keep the public health objectives in the forefront. We cannot say that an ordinary municipal engineer is so trained to-day. When he is trained in public health, the health department should transfer the duty of refuse collection and disposal to him. He may be given sanitary inspectors to work under him.

90. The collection and disposal of excreta, the cleansing of drains are actually carried out by bhangis or sweepers. They are doing a great humanitarian service and should be treated not as outcastes but with special consideration. They should be given good housing, water supply, latrines and other necessities. The stigma of social inferiority which they suffer from should disappear by mobilisation of public opinion. As Mahatma Gandhi emphasised throughout his life, every mother is a bhangi to her child and every man should be willing to be a bhangi when the need arises. Every public health engineer should be proud to feel that he is the arch bhangi of the community. We have noticed that the living conditions of sweepers have been badly neglected in many municipalities. Social duty and self-interest demand that the physical environment of the sweepers should be improved by the municipalities immediately. We feel that this should receive a high priority among our short-term plans.

CHAPTER VII

FOOD, DRINK AND MILK

Food, drink and milk should be produced, stored, transported and served under environmental conditions which are free from dangers of contamination and free from risks of reducing its orginal nutritive value as far as possible. This is one of the important functions of public health administration. The

danger of transmission of disease through food is greater in public food establishments than in private ones. As urban and industrial occupations compel people to resort to public food establishments to a much greater extent than rural occupations, the need for food and milk sanitation is greater in urban areas. The ideal farmer's life is more or less independent and self-sufficient. He produces and consumes his own food cooked in his own kitchen, drinks the water from his own well, and lives sufficiently far from his neighbour not to be affected by the other's state of disease, unless it is transmitted by insects like mosquitoes and flies or animals like rats. Only when he produces milk or fish or vegetables under unhygienic conditions and sells them to the people in the neighbouring town, he has to be watched. So food, drink and milk sanitation loses some aspects of its importance in a rural environment.

2. The objective mentioned in the first paragraph can be fulfilled only by (*a*) constructing a suitably designed structure, and (*b*) maintaining it so as to avoid the risks and dangers. The first part should be the responsibility of the public health engineer ; the second part the responsibility of the health officer through his food inspectors and sanitary inspectors. In some countries like the U. S. A., the second part is shared between the medical and engineering wings of the health organisation.

3. In India, there are fairly comprehensive rules regarding the various food establishments, etc., in municipal areas. The administration of the rules is very imperfect. There is a system of licensing of these places. The health officer can recommend the grant of a licence if he is satisfied about the sanitation of the premises. If not, he can recommend the withholding of it. But the man in charge of an insanitary food establishment can still run his business without a licence. The health officer cannot have it closed without a court order. The Municipality can prosecute the proprietor for conducting a business without a licence and have him fined by a court. The fine is light and easily paid. The health officer finds himself helpless and the whole business of enforcing rules becomes farcical.

4. We have heard few practical suggestions about how to enforce the rules and regulations more effectively. The fines can be made heavier, but it may be cheaper for the offender to pay a fine than to alter a building or to put up a suitable building. If the health officer is empowered to close down an insanitary establishment without reference to a court, it may lead to abuses by corrupt people, and is in any case an encroachment of civil liberties which a democratic institution will not accept. As the law stands, if the health officer closes down a business, he may be sued in court for losses incurred, and he must prove his case that there was a danger to public health in allowing the establishment to function. Unless there are clear-cut standards and the law arms the municipalities to close down an establishment falling short of them, judges will not give a verdict in favour of the municipality.

5. More rigid standards can be laid down by law, though it is doubtful if they will be accepted by municipalities as byelaws. Standard designs for sanitary food, drink and milk establishments can be prepared. Some can be built by municipalities for educative purposes. All these will have a limited value. But it is only the demand for better sanitation by the strength of public

opinion that will ultimately raise the standard. The business man knows that his customer is always right. He will improve his sanitary standard in food establishment only if the customer insists on it. At present the urban customer of food and drink wants only cheap food, not sanitation.

6. There are many kinds of food establishments. We will now consider the more important of them, detail the most obvious defects that have come to our notice and suggest means of improving them where feasible.

A. Processing establishments

7. In this category we will consider the establishments in which food is processed on a large scale for public consumption. Here the interests of public health demand that the quality of the raw product, the technique of manufacture, the environment in which it is manufactured, and the quality of the finished product should all be strictly controlled. Some of these establishments may be outside the limits of a municipality and may escape control by the municipal health authority. The laws should be amended so as to ensure better co-ordination between different health authorities in urban and rural areas, so that a wholesale producer can be controlled instead of the retailer. If an aerated water factory is located in Garden Reach and an inferior product is sold in Calcutta, the Calcutta Health Officer can prosecute only the retailer, and the Garden Reach sanitary inspector may not care to prosecute the manufacturer. The collection of samples of unwholesome and adulterated food and sanitary inspection of premises will be more useful if carried out in wholesale producing and processing establishments than from petty vendors.

8. Food establishments to be included in this category are slaughter houses, flour mills, bakeries, confectioneries, canneries, sweetmeat shops, biscuit factories, ice cream plants, pasteurisation plants, ice and aerated water factories, and kitchens in which food is prepared for consumption by a large number of people.

9. Some of these may be privately managed, others owned and managed by municipalities. We suggest that private slaughter houses should not be allowed in any municipal town. Municipal slaughter houses should be built in all towns to type plans approved by the Chief Public Health Engineer of the province. In the larger slaughter houses provision should be made for quarantine of the animals and veterinary service. The slaughter house should be located in a clean secluded place, should have a good water supply, cemented floors and drains, good lighting and ventilation, and arrangements and equipment for segregation of the different kinds of animals and for slaughtering one animal after another. The slaughter house should have adequate means of disposal of blood and wastes, facilities for cold storage of the meat in large slaughter houses, and suitable vehicles for transporting the meat without exposure. The vehicles should be easy to wash and clean and should not be used for transporting any insanitary material. Special attention should be paid to fly control in the premises and neighbourhood. Ante and post mortem examination of the slaughtered animal should be arranged for. The workers in the slaughter house should have lavatories, urinals and closets separate from the rooms where slaughtering is done, and spittoons in the slaughter house. We understand that the Government of India desire that no

slaughter house or tannery should be located within ten miles from the perimeter of an airfield, so that aircraft may not be endangered by vultures.

10. Flour mills, bakeries, confectioneries, canneries, sweetmeat shops, biscuit factories, ice cream plants, aerated water and ice factories, papad, vegetable ghee, vanaspati, papadam manufacturies and manufacturies of scented arecanuts, and large public kitchens may be privately owned. However, they should not be located in buildings which do not come up to certain minimum standards of sanitation. They should not be located amidst insanitary surroundings where flies may breed. The buildings should be clean, well lighted and ventilated, and should have impervious, smooth and washable floors. The utensils used should not affect the quality of the food or drink deleteriously. They should be designed for ease of cleaning and sterilisation by hot water or other satisfactory substitute. The process should be as closed and mechanised as possible, involving the least chances for handling and exposure to flies, dust, vermin, insects, etc. Special attention should be paid to smoke control and fly control in the rooms where food is heated or where fruit juice, milk and drink are exposed during their processing. The wrappers and containers should be sterilised before use, and facilities should be provided for sterilisation. Urinals, closets and wash rooms of a sanitary type should be provided for workers separate from the rooms where food or drink is handled. Workers should be provided with spittoons at the place of work. They should not be permitted to live in the rooms in which these processes are carried on.

11. Particular attention should be paid to the regular control of quality of the raw material and the finished product. Thus the bacteriological quality of the raw water and finished product in ice factories and aerated water factories should both come up to drinking water standards, and should be tested regularly by arrangement with a laboratory approved by the health department. The workers should also be certified medically fit. The control of large food processing establishments should be tightened up by suitable provisions in a Provincial Public Health Act designed to secure closer co-ordination of the municipal and provincial health departments. Standard specifications should be drawn up by the Provincial Public Health Engineer and Director of Public Health (or Health Services) and incorporated in a Provincial Public Health Act applied uniformly to all food processing establishments, whether they are within municipal limits or outside. An inspectorate should be established in the province for regular inspection and quality control in these establishments. Breaches of regulations by these establishments should be liable to deterrent punishment. It should be possible for the Director of Health Services to launch prosecutions against offenders.

B. Milk and other farms

12. In this category we will consider those concerns which produce articles of food for public consumption, such as dairies, piggeries, poultry farms, sewage farms, etc. They may be located in rural areas, but their markets will be in towns.

13. The control of cattle sheds and dairies has been rather unsuccessful in towns. In a city like Calcutta unlicensed dairies and cattle sheds are found almost everywhere.

14. The standard for dairies and cattle sheds are almost the same as for food processing establishments. The buildings should be well lighted and ventilated, the floors should be impervious and sloping to a suitably wide drain, there should be sufficient length and floor space for animals with facilities for watering and feeding them. The calf room and milk room should be separate, the latter being fly-proof. The milk should be drawn in suitable pails which will not affect the quality of the milk and can be sterilised. There should be facilities for washing and sterilising bottles and pails, and an ample supply of *safe water* for washing floors, utensils, etc. The straw and manure should be collected, stored and disposed of in a manner that carries no risk of fly breeding. Closets and washing places should be provided for workers separate from the cattle shed and milk room. The animals and milkers should be healthy. The milk should be examined and should come up to prescribed standards.

15. Municipalities will not be able to enforce these standards merely by prosecution. They will have to build model dairies and then compel the owners of cattle sheds to occupy them on payment of rent. We are diffident about the financial resources of municipalities to build a sufficient number of model cattle sheds. If the Provincial Government launches a scheme like the one that the Bombay Government is carrying out at Are, outside Bombay city, there is a chance of improving the present condition. The Bombay Milk Project requires a capital outlay of about Rs. 1,000/- per cow (or Rs. 50/- *per capita* of population that can be served by it). The ordinary milk supplier in towns is too poor to build a shed. He does not own the land. He borrows money at high rates of interest to pay for his cow, and the consumer pays for bad milk a price which is more than sufficient to build and maintain hygienic dairies if capitalised for five years. Co-operative milk farms may be promoted outside municipal limits ; this may solve this problem to some extent. These have been discredited in some places by the dishonesty of employees handling public milk and public money. If that fundamental frailty is overcome, co-operative milk unions can play the very useful role of improving the milk supply in our towns to the superior standards of western countries.

16. We have made our recommendations on sewage farms in another chapter. We consider that sanitation in other farms (such as piggeries, goat farms, and poultry farms) should also be controlled by the provincial health authority by registration and licensing on fulfilment of certain minimum sanitary standards.

C. Storage establishments

17. In this category we include the Government and private grain stores and the wholesale godowns ; the goods-sheds and ware-houses in railway stations and ports ; and also the cold storage establishments for storing perishables. We are not aware of any standards or regulations about these. The amount of food that is lost by spoilage or is consumed by rats from these storage establishments forms a respectable proportion of the food shortage

in the country. The public health consequences of encouraging rats to flourish in the neighbourhood of these godowns are well-known. We are of opinion that the buildings used for storage of food should be designed for the purpose, should be free from damp and should be rendered rat-free by structural alterations and periodic anti-rat measures. The ventilation, temperature and other conditions in the storage establishments should be such as not to encourage spoilage of the articles stored or to endanger the health of those who work in those places. Insecticides etc. may be used, but they should not affect the quality of the food, fruit or grains. We have no space or time to dilate upon the environmental conditions that should be ensured in each of these establishments. The public health engineer and the health officer should both be consulted and their joint inspection and approval should be made a condition for the opening of wholesale godowns, warehouses and cold stores in every part of the country. This may be done by a suitable provision in a provincial or national public health act.

D. Retailing establishments

18. In this category we include the markets, restaurants, milk bars, eating houses, canteens, tuck shops, ice and drink shops, railway platform vending, etc. Municipal bye-laws are full of rules, but their enforcement has been defective.

19. Exposing of food, cut fruit, etc., for sale on pavements should be stopped. Public opinion and police action can achieve this. It is beyond the powers of any municipal health organisation to prosecute and get every offender convicted.

20. Model markets should be built in every urban area. Particular attention should be paid to the provision of a pure water supply for drinking, washing and general cleanliness ; the paving of paths ; the lining of drains ; the provision of stalls so that the articles to be sold will not be exhibited on the floor ; lighting and ventilation ; latrines and urinals ; and arrangements for refuse collection and removal. Articles particularly likely to attract flies should not be allowed to be displayed in other than glass or fly-proof cages. The general standard of cleanliness will be inversely reflected in the prevalence of flies. Municipalities will find the building of public markets a profitable investment.

21. Wholesale markets should have adequate facilities for storage of perishables. In retail markets, storage of perishables overnight should be discouraged so that the articles may be fresh.

22. Restaurants, eating houses, etc., are often located in buildings not suitably designed. The kitchens are dirty and dark, the washing facilities and toilets are of a low standard, and collection of garbage most unsatisfactory. These can be improved only by a public demand for a better standard. But health departments should insist upon the provision of a boiler for hot water for sterilisation of utensils ; garbage bins of an approved pattern with lids ; an adequate supply of safe water ; and the provision of closets and washing facilities for customers and staff, separately, and separated from the kitchen and the dining room. The penalty for failing to provide these should be

deterrent. These minimal standards should be applied not only to public hotels, restaurants and eating places, but also to industrial canteens, tiffin rooms in public offices and railway refreshment rooms. In fact the restaurants in Government and municipal offices, the railway refreshment rooms, the industrial canteens and the kitchens in school and college hostels should come up to optimum standards and not minimum standards, and should be models for educative purposes. Travelling canteens that we saw in Madras were popular and clean.

23. The regular spraying of a suitable insecticide should be made a condition for granting a licence for a food retailing establishment to operate.

E. Food sanitation in pilgrim centres and alms houses

24. A large number of people visit temples, fairs and festivals and take, in a devout spirit, food and holy offerings prepared and distributed under unhygienic conditions. We have seen this in Puri and some of us know it is done in many other places too. Many suffer in health themselves. Afterwards they spread diseases to others when they go back to their homes. There is every chance of food being infected in these places because of the congregation of many diseased persons, who seek the solace of religion and the favour of the Almighty for cure, and because of the presence of filth and flies.

25. There are also charitably minded persons or institutions feeding the poor. The arrangements for cooking their food and feeding them are also far from hygienic in many places.

26. The ordinary standards of sanitation relating to restuarants and eating places cannot be applied in these situations. Religion and sentiment obliterate the value people normally attach to hygiene. It is a case of cleanliness being displaced by Godliness, instead of remaining next to it. No health authority dares inspect a temple kitchen or a poor feeding kitchen and criticise it. However, it is necessary at pilgirm centres and poor feeding centres that kitchens should be well lighted and ventilated ; that food should be kept covered and not exposed till it has to be served ; that water and food should be served by ladles and spoons untouched by hand ; that washing facilities should be provided for those who eat ; and that the leaves and garbage should be cleaned up and disposed of by burial or by feeding them to cows, etc. These should be accomplished by the health authorities by negotiation with temple authorities and managers of poor feeding establishments. The Public Health Act should also include provisions to cover these cases.

CHAPTER VIII

LIGHT AND AIR

Though light and air are not so directly and immediately involved in the interaction between health and environment as the chances of exposure to infection introduced by overcrowding, water, dirt, food, insects and rodents, the appreciation of the environment by an individual is largely determined by his subjective impressions about light and air. The satisfaction and enjoyment that a person derives in his work and play are dependent on the visua

and bodily comfort experienced in the environment. The skilful architect and the expert town planner are aware of this, and use lighting and ventilation to maximum effect. The landscape, parks, open spaces, aspect, width of roads, set-back of houses, arrangement of windows, internal and external colouring and decoration of buildings, are all designed by them to secure this appreciation.

2. Good lighting and good ventilation are conducive to better endeavour, better co-operation and greater and better output in homes, schools, offices, factories, etc. Where lighting and ventilation are such as to cause discomfort it has been proved that efficiency, output and health are affected in turn and accidents may occur more frequently.

3. From the health aspect in its broad sense, the minimum and optimum standards of light and ventilation should be set out in the Housing Code, Factories Act, School Building Code and Public Health Act. The village and town planners should regulate the use of land to facilitate the attainment of the optimum standards in natural lighting and natural ventilation. The public health engineer will give technical advice on the means of securing adequate light and ventilation, and the intricate technicalities of an actual installation will be under-taken by the illumination engineer or ventilation engineer. Thus there are four levels of technical service—the general laying down of standards, planning of land and open spaces, public health engineering to evolve and interpret standards, and specialised illumination and ventilation engineering to resolve difficulties. The distinction between the four levels is not generally understood. Rules and bylaws framed for lighting and ventilation do not take into account the variable requirements of lighting and ventilation in varying situations. They are applied often with a cast-iron rigidity by health officials who do not understand subtleties. Similarly each of the other professions concerned at the other levels of service is inclined to think that others have no business to talk of light and ventilation.

A. Building bye-laws about windows

4. Most building bye-laws in municipalities specify that the window and door area in a room should be at least one-sixth to one-seventh of the floor area. Separate standards for windows alone are not always specified. A door becomes ineffective for ventilation and lighting when it is closed for reasons of security. As windows are expensive, the houses built for the poor are provided only with the minimum.

A window is used for natural lighting and natural ventilation. To secure good lighting, the window should be as high as possible. Such a window will not be effective in securing a flow of cool air at the levels at which people live, work and sleep. Further, lighting may be adequately secured by a single window, while ventilation by a single window will produce stagnation of air. Rooms are used for different purposes and the light required will also vary. For instance the kitchen is a place where much more light and much cooler ventilation are required than in other rooms. The ordinary building bye-laws do not take into account these differences. They do not also take any notice of the fact that the thickness of the frame in a window may reduce the effective area by anything

from 15% to 50%. The reduction will cut out the area of visible sky and therefore day light.

5. According to prevailing by-laws in certain towns, a labourers' room can be built with a floor area of 100 square foot and a single window three feet by two feet in which the three-inch thick wooden frame and bars reduce the effective area by 48%. The window can be placed four feet above floor right under the eaves and give neither light nor ventilation. The inside walls may be dark grey and the next house may be six feet away with walls rising to a height of about thirty-five feet. This is fairly common.

6. New ideas and standards are being evolved. It may be difficult to incorporate them fully in a simple set of bye-laws understood by ordinary people. However, we consider that the following suggestions which are in elaboration of those made in clauses (10), (11) and (12) of para. 31 of Chapter III, may be adopted in the present state of our knowledge :—

(1) A room which is likely to be occupied by people should have at least two windows for cross ventilation unless it is artificially lighted and ventilated.

(2) The windows should have their sills not more than three feet above floor. The head of a window should not be less than four and half feet above floor in any case. Preferably it should be at least six feet.

(3) The windows should open on to external space directly or through a verandah not more than 12 feet wide.

(4) The area of windows satisfying conditions in clauses (2) and (3) above should be not less than one-tenth of the floor area in living rooms, one-fifth in kitchens, offices, schools, etc., and one-fourth in laboratories and drafting rooms.

(5) In passages, staircases and bath rooms, the windows need not satisfy conditions in clauses (2) and (3) above but the area of windows, sky-light or light openings, whether provided independent by or incorporated in doors, should be not less than one-tenth of the floor area.

(6) If the internal colouring of the walls and ceiling is dark grey, green or red, the window areas prescribed should be increased by 25%.

(7) If the frame of a window is not more than one-inch thick the area may be reduced by 15% below the standards in clauses (4) and (5) above.

(8) If the angle of obstruction to light is less than 26½° owing to the openness of layout or the height of the building the proportion of window area in clause (4) above may be reduced by a further 15%.

(9) If the angle of obstruction is greater than 63½°, the window area should be increased by 15%.

NOTE.—For computing the angle of obstruction to a window, draw a line from the lower sill of that window to the top of the building or wall opposite to it, perpendicular to the plane of the window, and find the inclination of that line to the horizontal.

If there is no building opposite to that window at the time of computation and there is no guarantee or certainty about the height to which a building may be raised on that property later on, the angle of obstruction should be taken as being 63½°.

If there is a law fixing a maximum height for buildings, the angle of obstruction should be computed on the assumption that the unbuilt building is in existence to the maximum height allowed by law on the neighbour's site.

If the owners of two adjoining properties arrive at an agreement about the height of the buildings that will be built, the angle of obstruction may be computed on the basis of those heights.

If the adjoining building site is a public street, or park, the angle of obstruction may be computed on the assumption that no building will be built on it.

In the cases in which the owner of the same property constructs many houses, he should voluntarily fix the height of the obstruction he proposes and give an undertaking to the local authority concerned not to exceed.

(10) Use of artificial lighting to the complete exclusion of natural lighting is not desirable, though not objectionable. When artificial lighting is used, minimum values in terms of foot candles should be prescribed for factories, schools, offices, hospitals, hotels, lodging houses, etc. They need not be pre cribed for private houses. The values will be the total of natural and artificial lighting required.

(11) If artificial ventilation is used, comfort air-conditioning may be considered satisfactory. In all other cases there should be ventilation openings, which will be equal to at least 2% of the floor space, cannot be closed air tight and will communicate with external air. No special provision of this nature will be necessary in thatched and tiled houses as the space beneath the rafters will be sufficient for effecting air changes.

(12) No open space need be provided on that side of a house on which no window or opening is provided for ventilation or lighting.

B. Smoke and dust control

7. Smoke fumes and dust are irritating. They obscure light and pollute the atmosphere. Inhalation of certain kinds of dust for long periods is harmful. Hence the control of smoke and dust is important.

8. In houses, the smoke will rise from an ill-managed and ill-built kitchen. Either smokeless fuel (such as charcoal and soft coke) should be used, or a chimney should be built. Many of the chimneys that we have seen are badly designed. They are built too high above the oven. Smoke will enter the chimney only if there is a proper hood, and will be carried away only if the changes of direction in the chimney are easy. If windows and doors in the kitchen are badly located, the breeze will drive the smoke out of the chimney instead of into it. We have heard people say that the H. E. R. L. (Hyderabad Engineering Research Laboratory) 'chula' developed by Dr. Raju is effective in eliminating smoke when firewood is used. Designs should be evolved, tried and standardised for adoption in urban and rural areas.

9. Apart from the control of domestic smoke, towns and cities have to tackle the problems of—

(1) smoke and dust emanating from factories, railway yards docks, etc., and descending in the neighbourhood ; and

(b) smoke, dust and fumes emanating inside factories and affecting the health of workers.

The first is described as atmospheric pollution and its control is a function of public health administration.

10. Atmospheric pollution can be effectively controlled only by zoning and the gradual shifting of factories from residential zones to industrial zones by legal compulsion and by offering suitable inducements and facilities to factories to shift. Even after shifting, the pollution of the atmosphere can be controlled only by offering feasible technical advice to the factories. They should be educated on the loss they incur through the escape of unburnt carbon particles into the air in the form of smoke, and given practical advice such as how to increase the air supply to ovens, how to improve the quality of fuel, how to raise the temperature of the fume gases and how to build taller chimnies. The method of enforcing the law about smoke control is a negative approach. The smoke inspector uses his chart, observes black smoke issuing for more than the time allowed and complains. The factory is on the defensive, some explanation is offered, and the matter is dropped. The positive approach should be through zoning of the town and technical services to factories as outlined above. The so-called ' dangerous and offensive trades ' should be disallowed in residential areas.

11. Electrification of factories where electricity is available would reduce atmospheric pollution.

12. Improvement of road surfaces and street watering will reduce much of the dust in small towns.

13. No open cooking place should be built adjacent to a road in poor housing. If so built, the food is likely to be contaminated by dust.

14. The second problem mentioned in para. 9 above belongs to industrial hygiene engineering. The Factories Act contains clauses meant to control them. The responsibility has been thrown on the owner of the factory to effectively control dust, smoke and fumes on his own initiative, but the Provincial Government is expected to lay down standards. These should be evolved early in consultation with industrial hygienists and public health engineers.

15. Most of the dust and smoke problems inside factories can be tackled by ventilation engineering. The use of hoods at the right place close to the point of origin of the dust, and the use of exhaust fans, ducts and arrestors will remove it. We will deal with this subject in greater detail in the chapter on industrial environment.

C. Ventilation

16. We have already touched upon certain aspects of ventilation in the preceding pages of this chapter.

17. Though the purity and oxygen content of the atmosphere are to be ensured, the main objective of ventilation is now recognised as regulating the rate of cooling of the persons in an atmosphere so as not to differ appreciably from their rate of production of heat and gain of heat—in other words, to keep them within the comfort zone. Natural ventilation may or may not be successful in achieving this.

18. We recommend that all cinemas and theatres in electrified towns and villages should have artificial ventilation by means of which the air in the occupied building will be circulated as well as changed.

19. We also recommend that operation theatres should be air conditioned in Provincial and district headquarter hospitals, where the effective temperature is likely to exceed 95°F.

20. We also recommend that third class carriages in railways should be fitted with fans.

21. The preceding three recommendations should be carried out within the next ten years.

CHAPTER IX.

CONGREGATIONS

Opportunities for transmission of diseases arise and increase wherever people congregate indiscriminately. It is therefore necessary to exclude the dangerous people, to immunise the healthy people and to modify the environment so as to reduce its potentiality for transmitting disease. The exclusion of dangerous people and the immunisation of the healthy are duties for which the medical officer of health is better qualified. The modification of the environment is a duty for which the public health engineer is better qualified.

2. In countries like India where the public health organisation is comparatively less advanced, most attention is paid to the *control* of disease in congregations than to other aspects of public health work. It is accorded the highest priority among the various activities of a health department, and we recommend that it should continue to be accorded that priority.

3. People congregate in fairs, festivals and camps. They also congregate in schools, factories, places of entertainment, meetings, etc., and in public transport facilities such as railways, trams and buses. It is not possible for the medical officer of health to immunise the healthy in all such congregations. Even the exclusion of the dangerously infectious people is difficult. The environment, however, can be controlled in all these cases to reduce chances of infection.

4. In the following pages we will consider the hygiene of the environment in all types of congregations except those in factories. The hygiene of the industrial environment will be considered in a separate chapter.

A. Camps, fairs and festivals

5. India is full of places of pilgrimage, where people gather in thousands and lakhs. There are towns where festivals attract crowds almost throughout the year, such as Puri, Allahabad, Banaras, Gaya, Nasik, Pandharpur, Hardwar, Tirupati, Chidambaram, Madura and Rameshwaram. There are other places where there are occasional mammoth gatherings—such as Kurukshetra, Kumbakanam, Rajahmundry. We have also got the problem of the refugee camps.

6. The housing of people in these places is generally unsatisfactory. There are Acts, like the Puri Lodging House Act, which aim at exercising some sort of control over the standard of accommodation provided in pilgrim centres by a system of licensing. In practice, however, the control is ineffective. During a festival every lodging house is crowded to its maximum physical capacity and no magistrate, health officer or sanitary inspector can prosecute the lodging house keeper for permitting overcrowding. Overcrowding is difficult to control. As every room in a pilgrim centre is likely to be occupied by a family, the minimum size of rooms permissible in lodging houses in such places and in all dharamsalas should be 200 square foot. The Provincial Government should pass legislation specifying the places for which this standard will apply. The rooms should be at least 10 feet high and should have at least 10% of the floor area in the windows. Every lodging house should have an open back verandah with at least four cooking places, and a sanitary latrine with cemented floor and adequate ventilation, with at least four separate seats, each completely screened off from the other. If a permanent pilgrim centre is so small that it cannot afford to have its own staff for enforcing these regulations, Government should appoint the health officer and the engineer of some other municipality or district board or from their own cadres to control building operations in conformity with the standards suggested above.

7. We also recommend that every dharamsala should be provided with at least as many latrine seats as there are rooms, and half as many bathing enclosures. Cooking inside living rooms in dharamsalas should not be permitted, but every room may be provided with a separate cooking place. If there are no water supplies in dharamsalas, they should be provided. The cost of these improvements should be met from (1) municipal or local board funds if the dharamsala is maintained by such a body, or (2) private or temple endowments if there are any for the particular dharamsala, or (3) Government religious endowments board if there are no other funds. Government should pass comprehensive legislation designed to improve the standard of maintenance of dharamsalas, and conferring upon the health officer and the public health engineer the powers of inspections and provision of these improvements. The Act should include powers for Government to have the improvements carried out by its own staff at the cost of the party concerned if the latter does not carry it out within one year from the receipt of a notice served by the Chief Public Health Engineer of the province or his authorised representative.

8. The standards about accommodation suggested above may also be followed in the construction of temporary accommodation in larger gatherings. It is desirable to build in addition large waiting sheds, 100 feet by 20 feet, with cemented floors. A length of 16 feet at one end may be divided from the rest by a dwarf wall four feet high, to serve as a cooking place. Every such ward should have at least three latrine seats within a distance of 200 feet and a water supply point within 100 feet.

9. We have already recommended in our short-term programme on water supply that all permanent pilgrim centres should be provided with piped water supplies. Provincial Governments should draw up lists of such towns and should force the water supplies on these towns even if the local authorities are not keen about them. We have also recommended that the cost of providing such water supplies should be shared between the province concerned and the Centre.

10. Even in the case of temporary and periodical gatherings of people, if the number of those who gather is likely to be of the order of 50,000 or more, it is better to install a permanent piped water supply as at Kurukshetra. The supply should be at least six gallons per capita per day and should be distributed through public taps at the rate of at least one tap per 150 persons. It is most important that the water supply in such places should be effectively disinfected and supplied for at least 18 hours in a day, if a 24-hour supply is not possible.

11. In the case of temporary gatherings likely to attract 5,000 people or more, the provincial public health engineer should be in a position to put up a temporary piped water supply, filtered and disinfected, from any available source. The portable units that we saw in the Central Provinces seem suitable. They include complete pumping, filtering and disinfecting outfits mounted on a trailer, and hauled by a car. As many of these units as are necessary to give a reliable service (with reserves for mechanical break-down) should be maintained by the public health engineer. The charges for operating these units may be recovered from the fair authorities but any controversy about the allocation of expenditure should not be a reason for not providing a supply of disinfected water.

12. The collection and disposal of excreta are the least satisfactory part of the sanitation of fairs and festivals. If the authorities in charge can do nothing better than putting up shallow trench latrines without water taps for ablution purposes and providing only a tenth of the optimum number of sweepers required for conservancy, the whole area becomes a hideous mass of filth and cannot be much worse without those latrines and few sweepers.

13. We have suggested in Chapter VI entitled "Measures for the hygienic collection and disposal of community wastes" that every permanent pilgrim centre should be sewered. If the entire cost is borne by Government it will probably be the best investment that they can make in public health. Hardwar has been sewered, and we would commend that example to every province for every permanent pilgrim centre.

14. In the case of temporary gatherings of people, sewerage will not be feasible. However, we have a few suggestions to make.

15. Shallow trench latrines are dangerous for undisciplined and irresponsible communities. They consist of only furrows in the surface soil, hardly six inches deep, with a translucent bamboo matting for privacy and no water for ablution. They are usually built far from the buildings, as they are known to be smelly. The latrines are too far away to be of any use at night. The entire grounds and the banks of rivers, channels, ponds, etc., are polluted in the privacy afforded by the darkness of the night. In the day time too the same thing goes on without worrying about privacy. Nobody cares to cover the excreta with earth even if he uses the shallow trench latrine, as he is almost sure that the earth around has been polluted.

16. If an adequate number of sweepers can be ensured, service latrines are better than shallow trenches. In such cases, there should be a cemented floor, and a dwarf wall to sit on. The excreta may drop into a trench in which some sand has been spread. The latrines should be cleaned at least thrice a day. The availability of sweepers is however, a doubtful factor.

17. We recommend the construction of well or pit latrines in such places. The wells may be about six feet in diameter. Four latrines may be built over them, or they may be sealed by a concrete slab and the excreta from the latrines may be led into them by a very short length of pipe. The wells or pits may be lined to the minimum extent necessary to prevent caving in, and the depth of the well may be 15 to 20 feet or about three feet below sub-soil water level. These wells should not be located within 30 feet of any other shallow well used for water supply.

18. These wells may become filled with sludge after use for about 30,000 to 40,000 man-days. After that the well should be filled, and a new well should be dug in the neighbourhood. It is better to have a number of these wells put up on mela grounds, and a temporary type of latrine built during melas.

19. We would also suggest the building of septic tank latrines in which the capacity of the septic tank is about one cubic foot for 80 to 100 man-days. The effluent should be absorbed in a gravel trench.

20. If it is not possible to build well latrines or septic tank latrines, we recommend the construction of deep trench latrines, six to eight feet deep. If these latrines have to be put up year after year, it is worth while lining the sides with precast concrete slabs which can be taken out and cleaned when the latrines are closed up after the fair. In case of a deep trench latrines, the health department should arrange to spray every latrine every two days with D. D. T. to control fly breeding. Deep trench latrines are, however, unsuitable for use by children. As they form a large proportion of the usual crowd in a mela, we recommend that a few service latrines should be built for their use.

21. In the case of all types of latrines referred to above, there should be two or three water taps or well, within fifty feet of each public latrine, for ablution purposes. It may be worth-while building a few ablution chambers separately.

22. A number of public urinals should be put up, apart from latrines, on every street and particularly near bathing ghats in a mela. The urinals that

have been put up at Kurukshetra refugee camps are sanitary and consist of four seats formed by a cross of screens over a pit or borehole filled with stone or brick bats. In addition, we would suggest a few more urinals with more privacy for use by women.

23. Refuse collection is also defective in fairs and festivals. The streets should be cleaned at least twice a day. We would recommend the provision of public dust bins in which the refuse can be burnt in the bin itself, similar to these installed in the Kurukshetra refugee camp. That portion of the refuse which cannot be disposed of in this manner may be removed, and buried or dumped at least half a mile away. The composting of nightsoil or refuse is not likely to be done at melas with due regard to the dangers of fly breeding. It should not be allowed.

24. We recommend that good infectious diseases hospitals should be built with observation wards at all permanent pilgrim centres. These should be equipped and used for isolation and treatment of cases of cholera and small-pox. Some of the important towns in the United Provinces have them. There are many other places without such facilities.

25. Food sanitation is a difficult problem in pilgrim centres. The road-side sweetmeat shops swarm with flies, which breed in the polluted soil and the heap of rotting refuse. Unless the general sanitation is improved by provision of water supply, sewerage, etc., food will always be exposed to chances of contamination by flies. The improvement of general sanitation on the lines recommended is most urgent.

26. We would also recall the recommendation we have made elsewhere (Chap. VII, paras. 25-27) with regard to the preparation and service of holy offerings in temples and of food in poor feeding houses. The construction of proper kitchens, the use of safe water for cooking and washing of utensils and the service of food untouched by hand are the ideals to be realised. Mere legal enactment will not bring about their realisation, but tact and contact with the managers of these establishment may.

27. We recommend also the construction of an outpost consisting of two rooms on every road leading to a mela camping ground or a pilgrim centre. The outpost can be used as a centre for checking whether those who come in and go out are seriously ill with any infectious disease, and also as a centre for immunisation. It can be used also as a place for collection of pilgrim-tax, if such a tax is necessary for financing water supplies, sewerage, etc., and maintaining an efficient health service in the area. A tax of about four to eight annas per head may be sufficient. Dr. A. C. Banerjee, Director of Health Services, United Provinces, has suggested eight annas to one rupee per head on all pilgrims entering Hardwar.

28. We recommend that places which are predominantly pilgrim centres, sanitoria or spas should be run as Government townships. Central legislation should be passed to enable a Provincial Government to take over the sanitation, health and all other municipal functions of such places in the province.

29. We confess we are at loss to suggest any other means of reducing the post of innumerable beggars with horrible diseases, who collect at fairs and festivals, exploit the public and endanger their health. Some partial control may be exercised through police and health surveillance at these outposts. However, the ultimate care of these unfortunate persons is a larger issue lying beyond our terms of reference.

B. Schools

30. Schools are places where children from all classes of society congregate and can communicate diseases to one another. They are also places where they imbibe ideas. The hygiene of the environment in the schools should be of a high standard from the point of view of prevention of disease and, even more so, from that of practical health education.

31. Codes have been adopted in various provinces suggesting certain standards in the construction of school buildings. There is also a system of building grants whereby school managers can claim a part of the money spent on a school built to approved standards. Some of these codes are idealistic. We have perused the report of the school Buildings Committee of the Central Advisory Board of Education in India, Ministry of Education (1946), and find their standards generally suitable.

32. In practice, however, the amount of money available for building grants to schools is limited and the pressure for admission in schools has been increasing phenomenally. Education is rarely self-supporting. It has been impossible for middle-class communities to raise sufficient money to put up a satisfactory school building. Village schools, town schools and city schools are all overcrowded. We feel that the system of utilising the existing accommodation by working in shifts will spread and that evening classes will become a normal feature.

33. In such a situation, we feel that a constructive approach should be made. Schools which do not have even a minimum of six square feet of floor space per pupil, even a minimum area of 150 square feet in each class room, even one well or water tap within a distance of 50 yards, and even one urinal for 60 pupils should receive positive help from Government. A survey should be carried out, and these schools in which even these very low standards have not been attained should be suitably enlarged or improved to these standards by requisitioning or renting other suitable buildings or by altering existing buildings. Government may charge interest not exceeding 4% on the amount of money they spend for improving such schools but should not levy any centage or departmental charges for supervision. We recommend this constructive plan to be carried out in the course of five years.

34. We have recommended in the chapter on Housing that provision should be made for a school building in every satellite town of 10,000 or over that will be built. The school itself should be built and equipped to the optimum standards recommended by the School Buildings Committee and rented out like other buildings, charging rent of Rs. 3/- to Rs. 4/- per month per 100 square feet of floor space. This will give a return of 3% on the outlay.

35. The School Buildings Committee has stated in Section 9 (dealing with lighting, heating, ventilation and sanitation) of its report that " the ascertainment of such standards for Indian schools is a matter or urgent importance which should be investigated without delay by an expert committee."

36. In the matter of lighting and ventilation, we recommend that windows provided on the east and west walls of a class room should have sunshades or verandahs to cut out direct sunlight. In the case of windows facing north or south, these may be optional. In the case of village elementary schools in the hotter parts of India, windows may be omitted and dwarf walls may be built to a height of four feet to form class rooms. In this way, there will be ample ventilation and, at the same time, the students' attention will not be diverted by things happening outside the class room. The cost of the building can be reduced considerably by this device. However, the different classes should be screened off by bamboo mats or walls to reduce diversion by external noise.

37. The space provided for ventilation and lighting, either as openings above a certain height or as windows, should be about 20% of the floor space. The space so provided should be distributed in more than one direction in order to secure cross ventilation and adequate distribution of lighting.

38. We recommend the use of thatch or a ceiling of some sort below tiles or corrugated iron sheets in village schools to keep them cool in summer. The use of corrugated iron sheets without a ceiling is inadvisable.

39. As regards sanitation, we would recommend for day schools the following standards for adoption :—

Optima	*Minima*
Separate conveniences for staff and for students and for different sexes.	Separate conveniences for staff and for student and for different sexes.
One urinal seat for every 40 members or part thereof, and one latrine seat for every 60 members or part thereof.	One urinal for every 60 members or part thereof and one latrine seat for every 100 members or part thereof.
Water taps for washing at the rate of one for 100 members or part thereof.	Water taps may not be provided if there is no piped water supply, but at least a well, tube well or other source of water supply should be provided within 50 yards.]
Drinking water should be provided preferably through fountains or taps turned upwards, or from closed galvanized cisterns, fitted with water taps, at the rate of one for every 100 members or part thereof.	At least one mud pot or galvanised cistern holding four gallons of water to be provided and to be fitted with a water tap.

40. The latrines and urinals in schools should be connected to sewers, if feasible, or to septic tanks or to pit or well latrines or boreholes.

41. The sale of food by hawkers in and around schools should be prohibited by law. The students should have some space, at least a shady open space, to take their food, brought from their homes as far as possible, or sold from a kitchen directly under the supervision of the school authorities. Such a kitchen should be built on the premises and should come up to the standards expected of a restaurant kitchen.

42. We also recommend that health authorities should undertake to disinfect school furniture with D. D. T. periodically for a small charge. Bugs, etc., can be controlled in this manner.

43. The provision of adequate play-grounds for each school is impracticable in towns of over 50,000. Schools in such places should be permitted to use public parks and play-grounds for sports and games, drill and jymnastics. In smaller towns they be required to arrange for their play-grounds.

44. Villages generally have sufficient open spaces which can be used as playgrounds and it is not necessary for the village schools to own them.

45. The need for hostel accommodation for students and housing for teachers is being felt acutely in the cities. However, this problem is fundamentally the need for more housing accommodation that we have already dealt with in Chapter III. There is nothing specially to add to our recommendations there.

C. Places of public resort

46. Cinema houses and theatres are springing up in large numbers in cities and towns in spite of the control over building materials. They seem to be fulfilling a public demand for an escape from the innumerable worries experienced by the middle class, for an urge for spending felt by the labourers and for an urge for investment felt by profiteers.

47. The standard of cinema houses and theatres in cities is fairly satisfactory. There are detailed municipal bye-laws to be complied with for fire protection, accommodation and sanitary conveniences. The patrons also set the standard. Cinema houses and theatres, which are of a poor standard, are not patronised. The owners therefore spend money and improve them to attract patrons.

48. In the mofussil towns and industrial areas, the cinema houses and theatres are not so clean. Regulations and bye-laws are also not so specific.

49. The use of fire-proof materials and the provision of adequate fire escapes and fire-fighting appliances should be insisted upon in these places. We consider that there should be at least one door, seven feet by four feet wide, for fire escape for every 100 seats or part thereof. It should not be closed by anything other than a curtain and its positions should be clearly visible to the audience. Tent cinemas and touring cinemas should not be permitted for more than a month.

50. Audiences in big towns prefer comfortable chairs, but those in small towns are willing to tolerate less comfortable accommodation if it is cheaper. We have no particular recommendation to make about this, except that at least five square feet of floor space should be available per capita in the auditorium.

51. We have recommended elsewhere (Chapter VIII, para. 18) that in all electrified towns and villages the cinemas and theatres should have artificial ventilation. This should be effected by fans for circulating the air and by exhaust or propoller fans which can effect at least six air changes per hour. In non-electrified towns, we recommend that smoking should be prohibited.

52. There should be an adequate number of urinals for the audience, and separate toilet facilities for the green room. The number of urinals should be not less than one for every 75 seats or part thereof, about 75% of the total number being for men and the rest reserved for women. The urinals and latrines should be flushed and cleaned, and the contents disposed of in a septic tank if no sewerage system exists.

53. Service of refreshments in most theatres is far from hygienic. The glasses are not washed properly. Either a water tap or at least 40 gallons of water should be provided in a cistern with a tap for washing glasses. Sale of ice-cream in theatres should not be allowed unless its source is approved and certified by the health officer.

54. The municipality should insist upon disinfection of the cinema and theatre seats with D. D. T. or other satisfactory insecticide at least once in three months. The work may be undertaken by the municipality itself on payment of actual charges.

55. With regard to public bathing places and swimming pools, there are well-known academic standards, but we realise their futility in India in practical implementation. Where facilities are provided by a club, it is comparatively easy to attain these standards. But the majority of public bathing places and swimming pools are open to all and sundry and the public are free to pollute them. In such a state of affairs it is impossible to control them.

56. We are of opinion that municipalities should not encourage such free amenities. It is better to work up to certain standards and levy a fee instead. The following are the minimum standards we recommend.

57. Municipalities should maintain or insist upon the maintenance of life-saving appliances in bathing beaches. They should also build, for the use of bathers, an adequate number of urinals connected to sewers or septic tanks and leaching pits. The standard of cleanliness of these urinals should be really high if they are to serve their purpose, namely, preventing the pollution of the beach, the pool and the water.

58. An adequate number of dressing booths should be built at these places.

59. The use of the booths by beggars and persons suffering from communicable diseases should be prohibited. This means employing a caretaker who should also be responsible for general cleanliness.

60. Other places of public resort are the public parks. We recommend the provision of water taps for drinking water and the provision of public conveniences containing five seats, two for men, two for children and one for women in every public park. The type of latrine should be such that the excreta can be disposed of safely at site. A certain number of benches should be provided in parks and at least 70% of the accommodation should be reserved for women and children. We also recommend that letter boxes should be provided in public parks.

D. Public transport

61. We will consider only three important means of transport, namely, (a) Railways, (b) Tramways, (c) Buses. Overcrowding has become insufferable

in all the three, and the chances of spreading disease by contact have also increased. It is beyond our province to suggest any measures for relieving overcrowding in public transport systems. We will confine ourselves to the hygiene of the environment.

62. Regarding railways, the Railway Board's circular No. R. 44. P/61, dated the 10th November 1945 (Appendix V), contains the standards of amenities accepted by them for Class III passengers at stations on all State-managed Railways and Class I railways. These are satisfactory as post-war plans. However, there are many stations falling short of these standards.

63. We understand that a Committee has recently been constituted under the Chairmanship of Mr. A. V. Raman, Editor, People's Health, Madras to report on railway sanitation in the Madras and Southern Mahratta and South Indian Railways. We shall await the detailed recommendations of this Committee with interest.

64. In our opinion the supply of drinking water at railway stations calls for improvement urgently. Every supply should be chlorinated. The water should be tested bacteriologically every week from trains and from different stations, and should satisfy the bacteriological standards of drinking water. Railways are inter-Provincial carriers and their standards should be above suspicion.

65. We are of opinion that it is most dangerous to supply to the wash basins of carriages water that is not safe. People rinse their mouths with this water on the presumption that it is safe. It should comply with bacteriological specifications for drinking water.

66. The sitting accommodation provided on the platforms of stations is totally inadequate. Against the Railway Board's target of benches for 9 per cent. of the passengers we find practically nothing even at stations like Howrah.

67. We have already recommended that third class carriages in railways should be fitted with fans. (Chapter VIII, para 20). In view of the overcrowding in Class III, this amenity is most urgently required for that class.

67. The actual maintenance of latrines is far from satisfactory at small stations. This should be improved.

69. We do not know whether there is a regular programme of disinfestation, of carriages in all railways. Disinfestation with D.D.T. spray of all carriages of all trains should be carried out at least once in two months. We consider this an urgent necessity.

70. We also recommend that, at all railway stations in districts where plague is prevalent, a fumigation should be provided for fumigation of all incoming and outgoing consignments of grain. Railway sanitary inspectors should be required to do this work during opidemics at the request of the Provincial Director of Health Services.

71. With regard to trams, we suggest disinfestation with D.D.T. of all trams once in two months. The same recommendation will also apply to all buses—State or private. Garages and service stations may be willing to

undertake D.D.T. spraying on payment of standard charges. Such garages may be licensed, and a certificate may be called for from them that disinfestation has been carried out at specified intervals.

72. Waiting facilities, refreshment facilities and toilet facilities have not yet been provided on a satisfactory scale for long-distance passengers by buses. We would urge that every municipality should build bus stations, and charge a fee from bus companies. They should also build model restaurants at such stations and have them run by licensed caterers. The investment on these amenities will bring good returns in money and comfort. Public conveniences and bath-rooms should be provided at all such stations. Safe drinking water should also be provided.

CHAPTER X

POLLUTION OF STREAMS, LAKES AND BEACHES

Rivers, lakes and beaches have been revered and sanctified by religious traditions in India for centuries. However, as in other matters, practice is far removed from principles. These bodies of water are polluted by the discharge of wastes and excreta by individuals, muncipalities and factories without sufficient consideration for the health of other users of the same water, or for conservation of aquatic life or for beauty. When the flow in a stream is reduced in volume by drought and particularly when dissolved oxygen in the water is low on account of high summer temperatures, the discharge into it of putrescible matter of high biochemical oxygen demand converts it into a foul, black cesspool at some point downstream. When the monsoon floods come in, the nuisance is mitigated or disappears. This offence against public health should be controlled effectively.

2. We have seen some part of the municipal sewage of Lucknow, Allahabad and Banaras being discharged into the Gumti and the Ganges without any treatment, and forming ugly sludge banks and sleek pools. The foul conditions now caused by the discharge of the sewage near the seashore at Bombay and Madras are common knowledge. There are many other towns discharging " sullage "—which is really sewage flowing exposed in an open drain all through the town—into rivers. Nagpur has surpassed many other towns in making 'Nag river' an open sewer, and we were surprised to find clothes being washed in it. There are sugar mills, distilleries, paper mills, tanneries and textile mills all over the country, converting small streams into cesspools. Above these are the unsewered small towns, where the conservancy system is inefficient and people pollute the river beds and lake margins every morning and evening individually instead of collectively.

3. The law about such offences is vague. They may be considered as nuisances, and the police can take action against the offender after he has committed the offence. Sections 268, 269, 270, 290 and 291 of the Indian Penal Code cover such nuisances. Sections 133-134 of the Criminal Procedure Code also refer to public nuisances. Section 277 of the Penal Code deals with the fouling of water of public springs and reservoirs.

4. The Bengal Local Self Government Act covers the offence of the fouling of water courses in Section 90.

5. The police have many duties and may not be able to take sufficient interest in the prevention or punishment of such offences. What constitutes pollution is hard to define to the satisfaction of a law court.

6. The health authorities are, therefore, unable to take effective steps to prevent such offences from being committed. They often lay down unattainably high academic standards, and take no cognisance of the gross offences actually committed.

7. The Health Survey and Development Committee recommended the establishment of Central and Provincial Water and Drainage Boards, and included among their functions the control of river and beach pollution. According to them, the Boards should be composed mostly of technical men, a few administrators and a few representatives of the public. They are expected to consider the pollution of a river basin as an organic unit, and tender advice to Government to take appropriate action. Such Boards will be useful, but they have not been constituted. We noticed that the utilisation of water from a river basin is placed under the control of the Central Waterpower, Irrigation and Navigation Commission of the Ministry of Works, Mines and Power. This Commission does not include any public health engineer, and apparently the pollution of river basins and the utilisation of rivers for water supplies are not included in the deliberations and activities of this Commission. We consider that Health Ministeries should be consulted in river development. Due emphasis should be given to the supply of drinking water and to the prevention of the pollution of rivers in the activities of the Central Waterpower, Irrigation and Navigation Commission, if Water and Drainage Boards are not established.

8. In other countries the control of river and beach pollution is effected by prescribing certain standards and by ensuring that they are complied with. These standards are evolved by three different methods of approach.

9. An absolute maximum limit of B.O.D. (Biochemical oxygen demand), chemicals, total solids, suspended slids or colour can be fixed for a sewage or a trade waste, for being discharged into a river. Administratively this is simple, but very often it is unnecessarily harsh. Thus, we know of some health officers saying that the B.O.D. of a sewage effluent should not exceed 15 p.p.m. or that a trade waste should have a pH of 7·0 or that the coliform count of a sewage effluent should not be more than 10 per 100 cc. Such absolute standards are not favoured by us.

10. The standards for the effluent may be fixed in relation to the volume of dilution water, as recommended by the British Royal Commission on Sewage Disposal. These are summarised below for information.

Standards of the British Royal Commission for Sewage and Sewage Effluents, 1912.

Classification of Standard	Required Condition of Sewage or Effluent		Type of Sewage treatment presumably satisfying the standards.
	5-Day, 65°F. B.O.D. p.p.m.	Suspended solids, p.p.m.	
(a) General Standard ..	<20	<30	Complete treatment.
(b) Special Standards Ratio of receiving water to sewage flow 150 to 300.	<60		Chemical precipitation.
300 to 500 ..	<150		Plain Sedimentation.
Over 500 ..			No treatment required.

These standards do not take into account the nature of the receiving water (*e.g.*, whether it is fast moving, slow moving, or stagnant), its initial oxygen Saturation, its temperature, and other conditions affecting its capacity for self-purifiction. We do not recommend these standards either, because the condition of receiving waters is so variable in different places of our vast country.

11. The third and most rational alternative is to fix the lowest standard for the receiving body of water downstream of the point of pollution and to stipulate that the load of pollution should be reduced to attain that standard. We recommend this approach in solving our problem. The standard in vogue in some States of the U.S.A. are summarised below.

Interest Compact Requirements of Connecticut, New York, and New Jersey for Treatment of Sewage Discharged into their Tidal waters.

	Class A Water expected to be used primarily for recreational purposes, shelfish culture, and development of fish life	Class B All other waters
1. Floating solids ..	Full removal ..	Full removal.
2. Suspended Solids ..	60% removal ..	10% removal of enough to avoid sludgs deposits.
3. Coliform bacteria in water samples during bathing season.	Probable number of not more th n 1 per c.c. in 50% of i c.c. samples.	
4. Dissolved Oxygen saturation in vicinity of outfall.	Not less than 50% during any week of the year.	Not less than 30%.

12. We are not in a position to suggest offhand any rigid standard for any particular rivers, and can only make general suggestions. In the case of well-known and sacred rivers, the dissolved oxygen content may be maintained not

lower than 3 p.p.m. (three parts per million) and the carbon dioxide not more than 40, p.p.m. at all points.

13. We recommend that the pollutional status of our rivers should be studied, that reaeration constants should be computed and that standards should be evolved. Research is necessary. The Water and Drainage Boards, if established, can promote this type of research. Otherwise, the All-India Institute of Hygiene and Public Health, Calcutta, may be encouraged to develop research in a few river basins.

14. Sewage treatment and industrial waste treatment should be carried out to the extent necessary to adjust the pollutional load to the capacity of the receiving body of water for self-purification. Each case should be judged on its own merits after study. When such questions crop up before a municipal or district health officer, he should refer them to the provincial public health engineer for advice. The provincial public health engineering department should either be staffed and equipped to investigate and decide on a standard for the effluent, or seek advice from the Ministry of Health in the Central Government. Though we are not yet ripe for laying down standards by legislative enactment, we can control pollution, by investigation and advice in each case. In course of time we should be in a position to prescribe standards.

15. We therefore recommend that provincial Public Health Acts should contain a provision to the effect that the discharge of sewage or industrial wastes into a body of water will be allowed only after the party responsible for the discharge undertakes to carry out the recommendations of the Ministry of Health with regard to the mode of treatment and standard of effluent whether made immediately or in future, and whether made on an application by the party or on the initiative of the Ministry.

16. We also recommend that the Ministry of Labour should instruct all factory inspectors to refer all questions of treatment and disposal of industrial wastes to the Ministry of Health and get its recommendations implemented. If the Factories Act has to be amended for this purpose, this should be done.

17. The disposal of sewage on land by farming during dry months after some preliminary treatment may be a suitable means of reducing river pollution. The discharge of the sewage in wet months into a flooded river may be unobjectionable owing to the large dilution. In such circumstances, the cost of expensive plant for complete treatment of sewage can be saved, and the sewage can be put to profitable use for food production. We commend this suggestion for sewage disposal in inland towns which can secure sufficient suitable land for farming.

18. The pollution of rivers, lakes and beaches by individuals can be controlled to some extent by constructing and maintaining sanitary latrines and urinals at bathing beaches and ghats. The latrines and urinals should be such that the effluent and excreta will be either connected to public sewers or absorbed in the soil. It is no use building a drain to convey the waste matter into the river or pond. However, real reform can come only by the education of the individual to a better standard of hygiene.

19. There will be problems of river pollution arising between different Provinces or States. If they are insoluble by negotiation between representatives of the Provincial Ministries of Health, the Central Ministry of Health should settle the matter as arbitrator. We are not in a position to say whether the necessary legal power should be secured to the Centre in the Constitution or otherwise.

CHAPTER XI

INDUSTRIAL ENVIRONMENT

Industries have been growing in India, faster than most of us realise. They have been associated with the growth of slums and vice in certain places. The policy to be followed in their location has been discussed by many planners. They have been the subject of deliberations of several Committees from several aspects, such as production, tariff and protection, country's economy and occupational health and safety. We have detailed in chapter I the reports that we have persued in connection with the work of our Committee. We have inspected a few factories—glass, textiles, tanneries, etc.—and a few mines. We have also heard the views of Chief Inspector of Factories. The subject is vast. We will confine ourselves to some broad observations on the hygiene of the industrial environment.

2. There is a tendency among many, when considering the health and hygiene of the worker, to think only of his environment in the factory. This compartmentalisation is incorrect and injurious. The Factories Act deals only with the conditions of work inside the factory, and it is said to be beyond the province of factory inspectors to pay attention to the nuisances caused in the neighbourhood, or to the environment in which the workers live outside the factory. The industrial doctor generally looks after sickness and accidents caused only during the working hours and inside the factory. We have heard a representativ e of the Millowners' Association say that the housing of the workers was not the responsibility or concern of the millowner. In mines there is further compartmentalisation, dividing surface conditions from under-ground conditions. The worker is organically one, whether he is working inside the factory or living outside. The hygiene of the industrial environment should include in its broad sense not only the conditions inside the factory but the conditions of housing, water supply, etc., outside too. Although this is not explicitly admitted, it is tacitly recognised by the fact that the need for a welfare officer is being increasingly recognised by progressive industries. Bad housing conditions will blight the character and efficiency of the worker and his family, and will also blight the character and tone of then eighbourhood where he lives. We have seen enough of this and have to express ourselves with some feeling. Attempts to develop industrial hygiene, industrial medicine and factory inspection in separate water-tight compartments without simultaneously improving housing and living conditions of workers should be deprecated. Broader perspective and better co-ordination should be brought to bear on the solution of industrial hygiene problems.

3. We have considered the question of housing of industrial workers in chapter III and have made recommendations. If possible, it is better to provide housing in which the labourer will not be segregated as a class and will not have the opportunity to develop a separate class consciousness and hostility to others. Absolutely free housing is not desirable.

The minimum wage should be fixed allowing for a reasonable house rent as a distinct item. The minimum housing accommodation has been suggested in chapter III. We have also stressed the importance of providing a kitchen, a latrine and some openspace in each family quarter, and also a water tap if possible in each quarter. No factory owner can afford to forget about the housing of his employees.

4. The control of the environment inside the factory is regulated by the Factories Act, and carried out by factory inspectors. This Act has recently been revised. The main changes are that the manager of a factory is now required to carry out certain measures of protection, fencing, ventilation, lighting, dust control, etc., for the safety and comfort of workers on his own initiative, without waiting for defects and remedies to be pointed out by the factory inspector. This is a big step forward and lightens the burden of the factory inspector to some extent.

5. However, the factory inspectors are too few in number and are not in a position to inspect every factory more than once a year. Their number should be increased so that factories may be inspected more often, preferably twice a year.

6. During inspection, attention is paid to fencing and guarding and whitewashing. The inspector also examines various registers about reporting of accidents, payment of wages, etc. The boiler inspector examines boilers. Other subtler defects escape notice. Dust control, lighting, ventilation, noise, etc., are not checked with any precision by precise instruments. There are no standards to judge by. Hence few factory inspectors have been in a position to make any constructive suggestions and have them carried out by factory owners. We find all varieties of defects in the smaller factories belonging to unprogressive proprietors. On the other hand, conditions in factories like the Empress Mills of Nagpur are good.

7. Large factories are designed and constructed with a view to making them suitable and reasonably comfortable. The small factories that spring like mushrooms are not so built. There are oil mills, flour mills, dhal mills, small brass and iron foundries, smithies, workshops and printing presses located in most unsuitable, dangerous, dilapidated, ill-ventilated slums and in corrugated sheet sheds. The workers in these places are baked in summer, soaked in rains, and choked by dust. We are of opinion that these small factories require more frequent inspection than large ones. The buildings should be passed as fit for the industry by a competent person before a licence is issued or renewed annually.

8. Factual data should be collected concerning actual environmental conditions in various industries. We understand that such work is going on now under the auspices of the Indian Research Fund Association. This work will be useful, and it should be extended and continued. It may be possible to devise

some minimum standards from such a survey and incorporate them in the Factories Act for the guidance of factory inspectors. Larger factories should be required to maintain dry and wet bulb thermometers in each department and record the readings each day in a register. These registers will be useful for evolving standards and many other purposes besides.

9. Functionally, a factory may be divided into four sections.

10. There will be a section for receipt and storage of raw materials. Structural strength, fire-proof construction, sufficient lighting to find one's way about and ventilation to secure about one air change per hour will be necessary in this section. The number of people who work here will be limited and there will be little overcrowding. The protection and preservation of the raw material may be the main consideration. Fire protection and safety precautions should be adopted. Dust control may sometimes be necessary at the point where the raw material is transferred into or out of the store. At least one foot candle of light may be required at every point in the passages.

11. The section in which the processing or manufacture is carried on will be the main factory. This will be occupied by workers. Their safety and comfort should not be neglected, though these will be subordinated to the requirements of processing. Generally, this section should be built at least to the standards of space, light, air and thermal insulation suggested by us for a National Code for Healthy Housing. There may be even additional requirements in respect of lighting, heat reduction and ventilation. The building materials, roofing material, windows, etc., should satisfy at least those standards. In computing the floor space for workers, the area occupied by machines should be excluded. However, we would not suggest the adoption of the standard for sound insulation as specified by us for healthy housing, because the reduction of noise to that level may be impracticable in many sections of factories. We would only suggest that noisy processes should be isolated from others.

12. There will be a third section, designed for receipt and storage of the finished product. This section will have to satisfy conditions similar to that for raw materials. Human occupation will be a secondary point. Fire protection will be required and a lower standard of lighting will suffice.

13. There will be a fourth section, the power house. Here, the environment will be hot. Ample ventilation will be necessary. Fumes and smoke may also have to be controlled. The worker will have ample floor space, but little comfort. Special safety measures may be necessary.

14. We are glad to note that, in recent years, Health Ministeries and factory inspectorates have been displaying an increasing awareness of the need for establishing industrial health and hygiene services. Some Provincial Health Ministries have been trying to appoint industrial hygiene officers in this organisation. The Labour Ministry of the Government of India is launching an Industrial Health Insurance Scheme and has appointed medical officers in that connection. An Industrial Health Research Unit has been constituted under the Indian Research Fund Association and is working at the All-India Institute of Hygiene and Public Health, Calcutta.

15. All these are progressive measures. However, we would like to point out that industrial hygiene is not entirely industrial medicine, or industrial toxicology, or health and sickness certification of workers. The orientation is so far having a markedly medical bias. The diagnosis of the fault in the environment in industry cannot be done by the ordinary factory doctor who certifies or treats the worker. It can be done by team work on the part of highly trained persons—the factory inspector, the specialist doctor and the chemist. The correction of the fault in the environment will have to be carried out by a specialist in industrial hygiene engineering a ventilation engineer, perhaps. We recommend that the training of a public health engineer should include such basic training in industrial hygiene. He should be consulted on these problems when he is qualified. Training in industrial hygiene should be given to three classes of professional men—doctors, engineers and chemists, with a slight difference in emphasis, so that each can collaborate with the other two in fulfilling his role.

16. There are some other amenities that should be provided for the comfort of the worker in a factory. These are (*a*) supply of drinking water, (*b*) provision of latrines and urinals, (*c*) washing facilities, (*d*) canteens and (*c*) creches. They should receive special attention.

17. We recommend that the drinking water should be disinfected, cooled and supplied untouched by hand. It is not expensive to put up an ice-box with a cooling coil and supply the water through the coil and a fountain, if there is a piped-water supply.

18. The devices used at Jamshedpur are somewhat expensive and not entirely free from the risk of contamination by labourers.

19. Public latrines and urinals in factories are often unclean. Service latrines should be discouraged as far as possible. Flushing of latrines into septic tanks is preferable. However, it is essential to ensure a continuous supply of flushing water at least during the shifts of the factory. We consider that the scale of latrine accommodation prescribed in Provincial rules under the Factories Act should be revised to conform to that recommended by us elsewhere (Chap. VI, para 82) for public latrines.

20. At present the workers ' colonies or factories are served by public latrines on a scale of one seat for 25 to 50 workers, which is totally inadequate. This number should be computed on the basis of users and not of workers only. The latrines will then be a little cleaner. We suggest that the number of seats should be increased on this basis in public latrines in industrial colonies till every house is provided with its own latrine as we have recommended elsewhere.

21. Washing facilities provided for labourers in factories are not inadequate but their maintenance is far from clean. This should be improved.

22. We have seen some industrial canteens. Some are good but most are run on a low standard of cleanliness. Even the good ones are not catering for any considerable proportion of the labour. We do not know the reason for this. However, we would repeat the general recommendations made by us about canteens and restaurants in Chapter VII entitled : " Food, Drink

and Milk ". Cleaning and disinfection of utensils with hot water should be insisted upon. Standard type designs should be prepared for such buildings. We suggested that such type designs may be evolved by collaboration between the Chief Adviser of Factories (Ministry of Labour, Government of India) and the Central Health Ministry. A public health engineer may be consulted on these designs. They need not be expensive, but should be effective.

23. We have also seen creches for children. Many are palatial buildings and are more suitable for other purposes. Those built in the coalmines are of this type and have not been used as creches. They are such a contrast to the hovels in which the babies and their parents live. We are sure a less expensive and a more effective design could have been prepared. On the other hand, we saw a fine creche, in a simple building, at the Manganese Mines at Kandri (near Nagpur) and we noticed that experiments were being made with different types of furniture for the children. We would emphasise that a creche is meant for *children*. It should be built and staffed and equipped to wash them, to clean them when they soil themselves, to give them a feed, and to let them play. These are simple requirements. In cold places there should be a boiler to supply warm water for washing and bathing the children. There should be toys and other play-things for them. The furniture should not be unduly lavish and not likely to be infested with vermin. A building is not everything.

24. We have seen the new baths for miners built to Government type plants at some of the coalmines in Asansol. They are also unnecessarily expensive.

CHAPTER XII

HYGIENE OF THE RURAL ENVIRONMENT

The fact that about 85 percent. of the people in India live in villages is well known. For the purpose of census, villages are defined as places with a population of less than 5,000. The population of an average India village may be about 500. Even the so-called towns, with populations of 5,000 to 20,000, are far from urban in their characteristics.

2. Villages are the backbone of our national economy. They are the sources of production of cereals, pulses, livestock, vegetables, fruits, oils and fats, etc. The livelihood of the people depends on agriculture, agricultural transport, agricultural marketing and cottage industries.

3. But villages are decadent and villagers are poor. They are often ill and mostly illiterate. About 11·6 percent. of the population did not enjoy good health according to a survey conducted by Lal and Seel (All-India Institute of Hygiene and Public Health, Calcutta) in a rural area. Our statesmen and leaders have emphasised time and again the urgent need for resuscitating dying villages and making them healthy, prosperous and enlightened. Rural reconstruction was dear to the heart of Mahatma Gandhi. It has many facts but we will confine ourselves to only one of them—the reconstruction of the environment from the point of view of health, taking up the different items in the order of gravity and importance.

A. Water Supply

4. Water supply is most unsatisfactory in villages. It is the most crying need. The supply is derived mostly from wells, and sometimes from rivers, tanks and canals. The wells dry up in summer in many parts of the Deccan, the Central Provinces and Berar, Rajputana, etc. Sometimes the water is saline. The wells are badly built and the water is nearly always contaminated. Nearly a quarter of the working hours of the housewife is spent in finding and bringing drinking water. Rivers, tanks and canals are constantly polluted. The effect is that, among the causes of sickness diarrhoeas and dysenteries rank next in importance only to malaria. Dr. Lal 's survey disclosed that diarrhoea accounted for 13·4 per cent. and dysenteries for 8·8 per cent. of the total sickness in Singur (near Calcutta).

5. We have made certain recommendations about the provision of water-supplies in rural areas in Chapter V. We consider that, just as crops wither for want of water, villagers also wither for want of safe and ample water supplies.

6. Whatever may be the financial stringency, Provinces should carry out a sustained programme of planned rural water supplies spread over a number of years. These water supplies should not be so evenly distributed all over the province that the benefits will become imperceptible. The priorities should be settled not on the basis of the loudest clamour of the local people but on intrinsic necessity. The work should be carried out by the public health engineering department or under its direction, and funds should not be spent without its control. A maintenance service should be established under the control of the public health engineer for maintaining village water supplies. Sampling and examination of water should also be organised. House connections can rarely be given. On an average, the capital expenditure may be about Rs. 3 per head of population served and the annual expenditure on maintenance can be brought down to about one to two annas per head per annum.

7. Investment on urban water supplies will bring financial returns, but those on rural water supplies will bring in invisible returns in the shape of health production and prosperity. The money has to be found. We will consider ways and means of financing them in the chapter of Finance (Chapter XIX).

B. Excreta disposal

8. The means of disposal of excreta is also very unsatisfactory in villages There are no latrines at all. People excrete in the fields and the back yards of houses and wash in tanks and rivers which are also used for bathing and drinking. We have already made some suggestions about the type of latrines that will be suitable for villages. (Chapter VI para. 76). The latrines should be such that the excreta will be disposed of at site without any risk of transmission of hookworm, etc., without exposure to flies and without contamination of surface water. Where the soil is soft and the water table at least ten feet below ground, the borehole latrine is suitable as a family latrine and

satisfies these specifications. In its cheapest form it costs Rs. 12 (or Rs. 2/8/- per head of population served) and once in two to four years it has to be rebored at a cost of about Rs. 8 (or Rs. 6/6/- to Rs. -/13/- per head per annum). Nothing cheaper has been devised.

9. Where the subsoil water is high, the hole is likely to get filled too soon, and is also likely to splash. The " mound latrine " has been used successfully in such situations in Ceylon. In this type, an empty tar barrel or cement pipe or brick shaft is built on the water-logged ground over the shallow borehole, to a height of three feet, and the seat is placed above it.

10. The borehole latrine and the mound latrine can also be used with a " water-seal plate "—and flushed out with half a gallon of water. Where the family is fastidious and can be relied upon to use the flushing water, this latrine is clean and the excreta is completely out of view and inaccessible to flies. This seat costs about Rs. 5 more than the ordinary seat in a borehole latrine.

11. Where more than ten people will use one latrine it is better to build a well latrine (or a "leaching cess-pit") and keep top covered.

12. A pit privy is also suitable, particularly as it has more cubic capacity, and will serve for a longer time before it fills. However, the precautions required against the collapse of the pit, the larger face to be spanned, and the greater need for fly control, make this type a little more expensive than the borehole latrine. On the other hand, the strongest point in its favour is that it can be built any where without any special tools.

13. We wish here to state that the risk of pollution of ground water by borehole and other types of latrines has been somewhat exaggerated. Under conditions of use in villages, in sandy soil, loamy soil or clayey soil, the risk does not extend beyond 25 feet. A radius of 25 feet gives a factor of safety.

14. In all these cases the sudden flooding of the borehole or the pit by entry of surface water should be prevented.

15. Septic tanks and absorption pits, trenches, or filters are of course the best and should be built if a man can afford it. As the removal of sludge from a septic tank is likely to be carried out infrequently in villages, we would suggest that they should have larger cubic capacity per capita (four to six cubic feet) than in the small towns, industrial colonies, etc. Very small septic tanks and borehole latrines are likely to be filled in a few months instead of years.

16. The provision of latrines in villages is beset with many difficulties. The villagers themselves do not want them in the first place, and built them only to humour the health officer or the officials whom they do not want to displease. To build latrines in numbers, an organisation is required so that materials may be procured at cheap rates, seats may be made to a standard pattern and the best value may be obtained for wages paid to labourers. Cheap effective type design should be available ; technical supervision should be available ; moulds, augers, etc., should be available ; and follow-up service should be available. We would repeat the slogan evolved by the League of Nations for antimalaria work : " Aim at persistence rather than perfection ".

The initial response of the people is generally disappointing. But every latrine built in a village by a villager or at his cost is a milestone in practical health education. It can be done through a little judicious subsidy in the early stages, and thereafter entirely by self-help. A rotating fund may be provided to make slabs and, as they are sold, the expenditure can be reimbursed. Rural reconstruction work or rural health work should always include the provision of money, equipment and personnel for this work. Public latrines in the villages cannot be a substitute for private latrines. We have explained the reasons for this view already in chapter VI.

C. Housing

17. Houses in villages are mostly owned, rarely rented. The great majority of houses have only one family—may be a joint family of many members, eating food prepared from one kitchen. The artisans and agricultural labourers do not build every part of their houses by hired labour. They themselves give their time to the construction of certain items. They are obliged to use local materials and labour to reduce the need for skilled workmen to the lowest level possible. Hence the cost of construction is reduced, and there is the urge to maintain one 's own house cleaner and better than a rented thouse.

18. The floors are often of mud, but clean.

19. Rooms are few, but there are verandahs, courtyards, " Kudams ", etc. The main function of rooms is to secure property and to afford some privacy for women in the presence of strangers. There is not much over-crowding, and whatever there may be loses its health significance in the context of outdoor life and occupation for the workingmen, women and children. The old and the sick may however find it a handicap.

20. Most of the windows in rooms are insufficient for lighting, and not effective for cross ventilation. They are closed at night and in the day-time for reasons of security and privacy.

21. The walls are dull and do not reflect light. But they are cool. The roof is often thatched and cool. However, it is likely to harbour rats, snakes and cobwebs. It has to be renewed every three or four years.

22. Domestic animals are housed very close to human beings. Their excreta is piled up, and breeds flies.

23. There may or may not be a separate kitchen. However, there is not much dust in the air, and kitchens are generally clean. Only the water used for washing the utensils is often indescribably dirty.

24. The setting of the house and the structure of the village are varied in different parts of the country. There is a segregation of communities by caste, occupation or religion, not by economic gradation.

25. The Indian village may be decadent and old, but it is a living growth following its own pattern.

26. There is no scope for radical alteration of the pattern. We have already indicated the directions in which a little control can be effected. These are the construction of one or two model houses for the most important social

workers or schoolmaster, the encouragement of street formation, the provision of at least two windows with bars etc. in rooms in houses, and the white-washing of interiors so as to increase the reflection of light. Radical alterations cost money, and the villager cannot afford it. It is necessary to persuade him to construct his cattle shed at least 25 feet away from the house, to dig a manure pit of 100 cubic feet capacity at the corner of his backyard, to dump his cattledung, straw, refuse etc. into it, and to put up and use a latrine. In addition the " premises sanitation " of the house should include spraying with D.D.T. at least once in two to six months as suggested by Dr. D. K. Viswanathan of the Bombay Public Health Department. This will control the transmission of mosquito-borne and fly-borne diseases and will make the rural environment healthier. We will deal with this matter further in chapter XIII.

D. Approaches

27. Village communications are very bad, particularly in deltaic areas. The roads are slushy or submerged in rains, and sandy or dusty in the drought. This is a great handicap to rural reconstruction and health work. The dry interior districts in the South and Central India do not suffer from this handicap : even if the roads are rough, they are fit for vehicular traffic.

28. Improvement of village communications is therefore essential in water-logged or deltaic areas. But it can be done only at prohibitive cost. The surfacing material required for a good road is not readily available in these places.

29. The Director of Rural Development, Assam, told us that the Rural Panchayat Boards in the province had shown the highest interest in improving village roads and that " miles and miles of roads have been built and drains have been cut ". This is very encouraging. Perhaps if rural co-operative marketing societies are established, our villagers will realise that they can sell more produce at better prices if they have better roads. If the village road can be improved, it will open the way to improved marketing of field and farm produce, and articles produced from cottage industries like potteries, silk, cloth, etc. It will also literally " pave the way " for better health services, maternity services and medical relief. However, where such roads are built, it is necessary to watch and ensure that the road do drains away the water and that they do not become malariogenic.

30. There are ponds and tanks in villages which are malariogenic and dirty. However, there is no paid organisation to keep them clean and innocous. Some people have suggested voluntary organisation. These show spirits of enthusiasm for a little while and then fade out.

E. Planning

31. The wholesale shifting or replanning of an existing village is impracticable. Planning can be confined only to new villages that have to be established.

32. The planner should incorporate in his plan all the good features of the local pattern of village structure. He should not let wet cultivation come right up to the houses in the village. The houses for artisans should have space

to carry on their professions. Houses for agriculturists should have space for their cattle and carts. Other suggestions made by us regarding village planning will be found in Chapter IV.

F. Food sanitation

33. There are few public food establishments in rural areas. Hence there is no need to make any special effort to sanitate public establishments. The collection of adulterated of food samples in rural areas is in our opinion a transfer of a police function of controlling fraud to a health official.

34. However, there is every chance of food in houses being contaminated owing to the absence of arrangements for excreta disposal and the great opportunities for fly breeding. These defects should be corrected.

G. Organisation

35. Improvement of the rural environment cannot be imposed from outside and sustained for long without the active effort and co-operation of the local people. This has been amply demonstrated in experimental work carried out by Government departments. Imposing an improvement from outside, when those who are to benefit by it are not mentally prepared to appreciate it, is expensive and wasteful. It requires a large Government organisation in the village. When we remember that the sole representative of Government in a village is a tax gatherer, policeman and registrar of vital statistics, all in one, and is often illiterate, we have to moderate our enthusiasm for village improvement.

36. The desire for improvement of the environment cannot be generated in the mind of the villager for its own sake. Life and welfare one and indivisible for him, whatever may be the interest of the various departments, technicians and scientists in particular aspects of it. If he is shown a way to earn more, or the advantage directly accruing to him from some expenditure is readily demonstrated, he will take to it quickly. He is shrewd, though not literate. He is interested first in economic uplift and secondly in improvement of health. Education appeals to him as the means of uplifting himself economically. He is also more responsive to personal approach than to impersonal approach. Hence a rural sanitation programme can succeed if it is organically co-ordinated with a programme for economic improvement, and if as many opportunities as possible are availed of to take the message of health to him personally. The services that he appreciates most should be rendered to him, and he should be personally requested to do something for himself. Good leadership will achieve a rapid multiplication of results by stimulating the interest and self-help of villagers. Otherwise, results will be sterile and disappointing.

37. Provision of rural water supplies and their maintenance D.D.T. spraying of houses in malarial areas and domicillary midwifery are services which are readily appreciated by people in the rural areas. They offer excellent opportunities for establishing personal contacts with individual villagers and their leaders. If they are availed of, the villagers can be persuaded to improve their houses, to build latrines and cowsheds, etc. The right type of health officer can capitalise these opportunities, if he can get suitable auxiliary personnel.

However, we find a great dearth of them. They have mastered technical details but lost their zest. The few health centres that we have seen display a petrifacation of their first achievement out of expenditure of Government funds—no growth.

38. The village school-master is still looked upon with some respect. He is poor, but has an influence with parents and children. His active support should be enlisted in carrying out improvements to the rural environment.

39. The rural Panchayat Boards that Provincial Governments are establishing now are local boards with smaller jurisdiction and some powers of local taxation. The reduction of jurisdiction is good. The Boards have some potentialities for service.

40. We would like to make a few observations about these potentialities. The improvement of the rural environment should not be thrust out of the picture or pushed into the background by the laymen and administrators who may be concentrating on elections, marketing, agriculture, composting, communications, etc. Whatever expenditure is incurred should be subject to the technical scrutiny of the local officers of the Government department concerned. Rural water supply should be provided by Government irrespective of the funds or attitude of these rural Panchayat Boards. The location and development of the source of supply should be decided on technical grounds by the public health engineering department.

CHAPTER XIII.

CONTROL OF THE ENVIRONMENT OF INSECT AND ANIMAL VECTORS OF DISEASE

We will confine ourselves in this chapter to the control of the environment of the mosquito, the rat, the fly, and the sandfly, flea, tick, bug, house etc.

A. Mosquito control

2. Malaria ranks highest among the causes of death and sickness in India. It is indisputably the first problem in public health in any province of India.

3. The report on the second session of the Expert Committee on Malaria of the World Health Organisation held in May 1948 at Washington states as follows (para. 5.1) :—

"The Committee, considering the part that modern chemotherapeutics can play in malaria control, agrees with the following propositions :

(i) Measures directed against the mosquito-transmission of malaria are, in the existing state of knowledge, the only methods which give permanent control. They should take priority wherever possible ;

(ii) Chemotherapy and chemoprophylaxis have an important part in the clinical control of epidemic malaria ;

(iii) Chemoprophylaxis, however, efficient, can be considered general only as palliative ;

(*iv*) Preventive drugs have, and will retain, an important part in personal prophylaxis ;

(*v*) Therapy plays a secondary role in the prevention of malaria. "
It follows from this authoritative statement that permanent control of malaria needs control of the environment, so that the vector species of mosquito may not breed and, even if it breeds, it may be disabled from transmitting malaria to human beings. Other measures are only ancillary to these.

4. Mosquito control is also required for the control of filaria and dangue.

5. It is true that road, rail, irrigation and power projects have resulted in the production or stimulation of malaria in the past. Volumes have been written upon this. The engineer has been blamed, and often rightly, for his ignorance about malaria. The rectification of initial mistakes costs more than their avoidance. The cost involved in lives lost, man-days lost, etc., on account of malaria has been estimated by malariologists and runs into astronomical figures.

6. Fortunately, the need for mutual distrust between engineers and malariologists is almost gone. The need for assessing malarial implications of proposed engineering projects and preventing the development of malariogenic conditions from the beginning of the construction programme is well recognised now. We understand that the Central Waterpower, Irrigation and Navigation Commission is consulting the Director, Malaria Institute of India, regarding antimalarial measures to be budgeted for in new projects. The Malaria Institute of India has also taken charge of malaria control in coalfields. If such conventions are established by public works departments, irrigation departments and the Railway Board, the results will be encouraging. Land reclamation schemes should also be carried out only after scrutiny from the point of view of malaria.

7. Till now, the public health engineering departments of provinces have taken no part whatsoever in mosquito work. If engineers are educated and trained in malaria control, they can take charge of large-scale work or permanent control methods very efficiently. We consider that the time has come when the engineer and the malariologist should not only cease to pull apart, but actually pull together. There are several engineering aspects in mosquito-control work which a malaria engineer can carry out better than a malariologist with a medical or entomological background. Drainage, filling, maintenance of mechanical equipment, etc., are some such aspects. There should be a triple alliance of engineering, biology and medicine to achieve mosquito control in the shortest time with the least cost. We have seen the good results of engineering measures at Delhi and in Mysore State. We recommend more concrete organisation of this alliance in all antimalaria organisations Central and Provincial.

8. All engineers and doctors are not qualified to undertake malaria control work. They require training. We are glad to note that malaria engineering forms an integral part of the training of public health engineers at the All India Institute of Hygiene and Public Health, Calcutta. A short course for

engineers is given at the Malaria Institute of India, Delhi, also. If other training centres are established in India, we recommend that they should also include training in malarial engineering for public health engineers.

The habits of malaria-carrying anopheles are so variable and their habitants are so diverse, that it would be impossible to generalise about the principles of design of permanent measures for their control. These measures should be based on a correct appreciation of the ecology of the vector species. The methods employed in principles of ordinary storm-water drainage will be wasteful and useless. Drainage may be unnecessary or even harmful in certain places. Cheap methods of cutting earthen drains without paving the inverts may be dear in the long run, and useless. There are many subtleties in malarial engineering and subsoil drainage. The medical malariologist has a general tendency to avoid these and resort to recurrent measures, because he has no background in construction. The untrained engineer has a tendency to imagine that it is all very simple.

10. The technique of malaria control has undergone revolutionary changes n the last 15 years. We had the age of quinine, the age of plasmoquine, the age of antilarval oiling and paris greening. They were all expensive, and imperfect. Emphasis was laid on species sanitation. Where money was freely available, permanent measures were carried out. Adult spray-killing with pyrethrum extracts came into vogue about 12 years ago, and was a remarkable success in many places. It was a less remarkable success in certain situations and with certain species, owing to the fact that the killing effect of pyrethrum extract was quick but not lasting. With the advent of D.D.T., the entire picture has changed. In this connection the following extracts from the report on the second session of the Expert Committee on Malaria of the World Health Organisation are pertinent :—

" Of numerous chemicals in this group of residual insecticides tested, D.D.T., has so far given the most outstanding performance. In the existing circumstances D.D.T. thus appears to possess many of the essentials of an ideal insecticide for the control of malaria, in that—in the dosage required—it is cheap, has a prolonged residual action, is non-toxic to man and domestic animals, and confers collateral public-health benefits through the simultaneous destruction of other disease-carrying insects. " (Para. 4.1.). " There is definite and overwhelming evidence that the recently introduced insecticides can be relied on as a basis for a widespread attack on malaria with the expectation of a significant reduction of morbidity in areas where they are properly applied. This opinion is based on the results available from many countries where D.D.T., has been used as an indoor residual spray and where its effectiveness has been demonstrated against different vector species of anopheline with wide variations in resting and feeding behaviour ". (Para. 1.4). " The Committee considers that the application of D.D.T. as an imagocide is the method of choice in a widespread attack on rural malaria, and that by its use a significant reduction of morbidity may be effected in the majority, if not in all, of malarious countries ". (Para. 9.3).

11. For the first time in the history of malaria control, we have in indoor spraying of D.D.T. a comparatively cheap, sure method of controlling rural

malaria and other insect-borne diseases. In addition to indoor spraying, antilarval work is necessary and suitable for mosquito control in urban areas, but in rural areas the population is diffuse and anti-larval work is expensive and imperfect.

12. The value of D.D.T. has been demonstrated in towns like Cuttack where the mosquitoes used to be a pest. It reduces cockroaches and exterminates bugs. It is the one public health service that is readily appreciated even by the illiterate, and provides thereby means of persuading and educating them to carry out improvements in their environment.

13. We are of opinion that Provincial Governments should extend rural malaria control by indoor residual spraying of D.D.T. to all districts where malaria is endemic. We have no hesitation in saying that, if such a service is rendered free for one year, the people will be ready to pay a tax to finance it and will demand its continuance from the next year. The cost per head of population will, we understand, vary from six to twelve annas per head per annum.

14. It is desirable to apply D.D.T. spray to every house periodically like white-washing. This is " Premises Sanitation ". It may be done for Government quarters, industrial colonies, etc., to start with, by the authorities responsible for white-washing. The same procedure may then be adopted for private houses too ; this will produce good results in the control of insect pests and insect-borne diseases.

15. Dr. M. O. T. Iyengar, Malaria Officer, Government of West Bengal, told us that, if a programme of indoor residual spraying is carried out in the rural areas of West Bengal for malaria control, the annual consumption of D.D.T. may be of the order of 500 tons. This is a cautious estimate. We think that there is a potential consumer capacity of at least 3,000 tons of D.D.T. in India per annum, if we include the requirements of the army, railways, industries and health departments. We do not know what it is now. The amount of D.D.T. required for one spraying for one room, 12 feet by 15 feet, is about one ounce. If two sprayings are done in the malaria season in a year in 32 million rooms, the quantity required will be about 1,800 tons. The demand will rise to 3,000 tons in the course of four or five years.

16. D.D.T. is at present manufactured mainly in the U.S.A., the U.K. and Switzerland. The production capacity in the U.S.A. is 100 million pounds (or about 45,000 tons) and provides an exportable surplus over their local needs. But the cost of 3,000 tons which India will require is nearly 1·8 million dollars (six million rupees at pre-devaluation rate of exchange or nearly Rs. 8·6 millions at the post-devaluation rate) at the lowest price quoted of $ 0·26 per lb. of D.D.T. Actually, the present price of D.D.T. in India is Rs. 4 per lb. and, at this rate, the cost of 3,000 tons of D.D.T. will be Rs. 2·69 crores. This is a big sum, and we cannot afford to use up our dollars on buying D.D.T. The tendency will be to retrench expenditure on malaria control work. We think that the correct approach is to establish factories in India for production of at least 3,000 tons of D.D.T. per annum. This is vital for the health of the nation, and should be accorded a very high priority. We understand from the quarterly bulletin (volume II, No. 1, page 70) issued by the Ministry of Industry

and Supply that they are estimating the present requirements of D.D.T. in India at 500 tons per annum and are considering the possibilities of producing that quantity. It will be quite insufficient for our needs. We urge that at least a 3,000-ton plant should be erected as early as possible by Government or with Government aid and control. The manufacture of suitable emulsifiers and spraying equipment may follow immediately afterwards, perhaps by private enterprise.

17. We wish to quote once again from the report on the second session of the Expert Committee on Malaria of the World Health Organisation already referred to. It says in para. 4·3 : " * * * * * the manufacture of D.D.T. is at present concentrated in non-malarious parts of the world, whereas in the malarious countries where this chemical is most needed there is hardly any local production. In these circumstances, any interference with the free flow of trade through any cause will have disastrous consequences, as severe and epidemics forms of malaria will appear in areas dependent upon control with D.D.T. There is therefore an emphatic need for planning and stimulating the production of D.D.T. on a regional basis particularly in the malarious parts of the world. "

B. Rat Control

18. Permanent measures of rat control are necessary for conservation of food grains in rationed areas, and for control of plague in the districts where it is endemic. We advocate the construction of rat-proof godowns in such places as early as possible, and insistence upon the storage of wholesalers' stocks in such godowns.

19. It is easy to convert existing godowns into rat-proof godowns by simple alterations. Every door and window should be altered to make the leaves open inwards. A dwarf wall three feet high can be built across the door-way or window on the outside. Over that a concrete slab can be placed to overhang a clear nine inches on all sides. The floor of the godown can be made solid, and all rat holes can be plugged with concrete. Rain water pipes can be removed. The roofing etc. should be suitably altered to facilitate fumigation.

20. We have not seen satisfactory rat-proof godowns in our towns. Even in Hyderabad where plague is endemic we did not see proper rat-proof godowns.

21. We also suggest that fumigation sheds should be built in all parts in railway goodsheds situated in districts where plague is endemic, and in Government grain stores, and that every consignment of grain should be fumigated with cynogas in the cart, lorry or railway wagon, before being unloaded into the godown, grain-store or goods-shed or warehouse when the health authorities make such a demand. If the bags are stored in rat-free grain stores after fumigation, rat-control will be quite effective.

22. We have emphasised the need for sound floors and solid walls in housing. Hollows and concealed spaces offer harbourage to rats.

23. In rural areas rat control cannot be effective. The small granaries in houses cannot be rat-free. If there is an outbreak of plague, the people should be evacuated and the place should be sprinkled or sprayed with D.D.T. Only the obvious rat-holes or vacant houses can be fumigated with cyanogas.

24. Improvement in the methods of urban refuse collection and disposal will result in decrease of food supply and other facilities for rats.

25. We do not want to detail other methods of rat control as they are less effective.

C. Fly control

26. The fly is the agent for mechanical transmission of many diseases. The control of the fly depends on the efficient collection and disposal of garbage, excreta, horse dung, and cattle dung in rural and urban areas. The circumstances favouring fly breeding are found in abundance in our cities, towns and villages. The innumerable insanitary cattle-sheds, sullage drains, public refuse depots, refuse dumps, trenching grounds, poorly managed compost heaps and sewage sludge drying beds are breeding millions of flies. Unless these are controlled, fly-borne disease will continue to take their toll of morbidity and mortality. Local control of flies by fly paper, D.D.T., swatting, etc., will accomplish little. We have made certain recommendations already on each of these matters.

27. We have also suggested the control of flies by D. D. T. spraying in deep trench latrines, and the burning of refuse in portable camp incinerators in temporary fairs and festivals. The use of D. D. T. sprays for fly control is likely to be effective in these situations, although we hear of the " reported prevalence, in Sweden and Italy, of Musca domestica resistant of D. D. T. and the development of resistant strains of this species after spaced exposure to D. D. T. in the laboratory."

D. Control of sandflies, fleas, ticks, bugs, lice, etc.

28. In D. D. T. sprays we have a method of controlling these too.

CHAPTER XIV

DESIGN AND CONSTRUCTION OF MEDICAL AND HEALTH CENTRES

The Health Survey and Development Committee has given some attention to this question, and has emphasised the need for evolving effective type designs and economical methods of construction (para 18, page 515, Vol. II of its report). If a health service is to develop in a province, it is necessary to make the best use of capital expenditure on structures. At present many schemes of expansion of health services and medical relief are held up because of excessive cost of buildings. A comparatively poor province like Assam or Orissa is financially crippled for further development of health services if it embarks on one project like the construction of a medical college.

2. In this connection we have got to take notice of the fact that the demand for hospital accommodation is increasing not only because hospitals are better equipped for treating more serious cases, but because the classes that used to disdain taking advantage of them are forced to do so now as they cannot afford the cost of private medical attention. The design of medical buildings is therefore a matter of great importance to our country in national planning.

3. We are not in a position to suggest cheap alternatives for every existing type design, but we think a qualified and trained public health engineer can assist materially in achieving the object if he is associated more closely with the design and construction of such buildings. At present the Public Works Department prepares the plans on requests which are not precise and the Medical or Health department approves the plans. The medical officers in the Health department are not well versed in following drawings and are unable to criticise effectively at the stage of planning. When the structure is built, it is perhaps unsuitable, but nothing can be done about it, because alteration at that stage is too expensive. The result is dissatisfaction and waste of public funds which could have been avoided.

4. We will indicate in this chapter the main defects of medical and public health buildings as we find them and the broad technical principles that should be applied in building them. Although they may seem vague, we feel justified in putting them forward, as they are rarely found in books.

5. The big general hospitals in presidency towns are fairly well built. Good service has been rendered in those buildings. However, occasionally we find money wasted on architectural flourishes where simplicity, dignity and elegance would have been more appropriate. We find money wasted on high ceilings, marble stains, dornic columns and capitols. Huge in-patient wards of unmanageable size have sometimes been built in these; lighting and cross ventilation are sacrificed and cheap wooden partitions are erected as an after thought.

6. The smaller hospitals and dispensaries are often housed in unsuitable buildings, particularly when they are run by district local boards. Maternity homes run by certain municipalities are also located in unsuitable buildings. The plumbing in many hospitals is not modern and in some hospitals it is not even safe.

7. Few buildings have been built as health buildings. Many health centres have been located in rented buildings. The same is the case with anti-malaria centres.

8. The location of a medical or health building depends on its function. Clinics, dispensaries, small hospitals, maternity homes, etc., are meant to serve the general public and hence easy accessibility and central location are more important than quietness, if all requirements cannot be reconciled. They should be well dispersed in a large community. On the other hand, a large general hospital should be in a quiet, dust-free place, with room for expansion.

9. Infectious diseases hospitals, special hospitals for leprosy, tuberculosis mental diseases, etc., quarantine stations and senatoria should not be central or so easily accessible. A quiet secluded location is essential for such institutions.

10. The soil should be considered if there is a choice in the matter.

11. A good water supply is essential for every medical relief or health centre.

12. The function of the building should be kept in the forefront when designing it. For instance, in outpatient departments and ante-natal post-natal and child clinics, sufficient accommodation should be provided for those who wait for their turn for service—in the outpatient departments and in dispensaries such accommodation should be provided for those who wait for their turn for service—in the outpatient departments and in dispensaries such accommodation may be in an open verandah or in partially or fully closed room, according to climatic conditions. In providing such accommodation the principle of circulation of traffic one way should be followed. Thus the patients should enter, take his place in the waiting room, move up to the nurse or doctor for consultation or examination, then move on for treatment or medicine from the dispensary and out by an exit without having to come back. The consulting room for the doctor need not be bigger than necessary for accommodating him, an assistant and, say, two patients at a time. There should be a screen, a dressing enclosure and couch for examination of the patient place adequately lighted and having sufficient privacy.

13. A closet will be necessary for collecting samples of urine, etc. in certain clinics. Some closets will be necessary for use by those who wait. A few will also be necessary for the staff.

14. Suitable storage space should be provided for drugs, dressings, instruments, etc.

15. If the building is meant for public health education and propaganda, there should be a place where people can assemble, adequate wall space for posters and exhibits and a few blackboards. A health centre as such is an educational centre. It should contain sufficient open grounds for demonstration of latrines, wells, etc.

16. A hospital is meant primarily for inpatients. While it is necessary to build a kitchen in a big general hospital, this is unnecessary in cottage hospitals, etc., where the relations of the patient can bring him his own food. Thus kitchens may be omitted in hospitals having less than ten beds unless they are isolated and are more than a mile away from a town.

17. If kitchens are built, their design should be on the principles we have already stated (Chapter VII, para 6). Adequacy of lighting, ventilation, smoke-control, water-supply, etc., and facilities for washing and sterilisation of utensils, and for storage and transport of food towards unexposed to flies should all be ensured in the design.

18. Compactness of layout is desirable in a hospital. Long verandahs and covered passages connecting different blocks cost a lot of money, waste of time for the staff and waste of space in a thickly populated town. We would like to recommend vertical development wherever necessary, instead of horizontal, development. If separate blocks have to be built, it is cheaper to provide umbrellas than to build covered passages for the portection of the staff. Doors passages, staircases and landings should be wide enough to take a patient on a stretcher and preferably a bed.

19. In the construction of wards, we would recommend limiting the maximum accommodation in one ward to about 20 beds. There may be 10

bedded wards. Paying wards may be built with cabins for one patient, two patients, or four patients, to suit varying pockets. Small wards are preferable for infectious diseases hospital.

20. There should be a space of at least six feet between centre to centre of beds of ordinary wards. Allowing an alley of six to eight feet between beds, the width of a ward may be 18 to 20 feet where beds are placed perpendicular to walls, 12 to 14 feet where beds are placed alongside walls. If verandahs are also made 12 to 14 feet wide they can be converted into wards in an emergency. Verandahs on both sides of a ward and an alley in the middle may not be necessary. Such an arrangement results in waste of space. A minimum of 75 square feet of floor should be allowed per patient in a ward. This should be increased to 100 square feet in a post-maternity ward if the infants are kept beside the mothers.

21. It is practicable to omit doors and windows and build dwarf walls 3½ to 4 feet high in the wards of hospitals on ground floors under suitable climatic conditions. In such cases there will be a considerable saving in the cost of building.

22. The flooring and walls of a hospital should be smooth, impervious and jointless. There should be no grooves and crevices in which infectious material can stay.

23. The " sanitary block " or bathrooms and closets should be provided in adequate numbers.—We recommend one closet for 8 to 12 beds, one bathroom for about 24 beds and one wash-basin or water-tap for about 24 beds. There should be a slop slink for washing bed pans, connected to a sewer or septic tank. The sanitary block should be connected to sewers wherever possible. We recommend decentralised septic tanks and disposal of efflluent in the soil for mofussil hospitals and isolated hospitals with at least four cubic feet of septic tank capacity per capita. The tank capacity should be larger in view of the fact that dis infectants used liberally in hospitals may find their way into septic tanks. The plumbing in hospitals should be of the highest standard possible. Ordinary fittings are not suitable for surgical sinks, slop sinks, etc.

24. A hospital should have duty rooms for nurses, pantries and linen rooms near wards, and a general store. There should be provision for X-ray and infra-red therapy in the larger hospitals.

25. Maternity hospitals should have separate labour rooms for normal and septic cases. They should have ample washing facilities, besides ordinary sterilising facilities for instruments. There should be a few septic wards too, isolated from the rest of the hospital in all respects. In large maternity hospitals, an operation theatre should also be provided. In maternity homes where only normal cases are taken in, the provision for septic cases in not so pronounced.

26. Children's wards in hospitals should contain railed beds from which children cannot roll off, and toys etc. for their amusement.

27. Every general hospital should have a laboratory for pathological examinations, with suitable lighting, benches, etc.

28. The allocation of beds for men, women and children for surgical and clinical cases, etc., depends on special conditions. In a general hospital, clinical cases, may be in the majority. In hospitals in mining areas, industrial areas, etc., surgical and accident cases may be in the majority. In infectious diseases hospitals the surgical cases may be few. The building of small wards enables the hospital authorities to change the allocation of beds according to needs.

29. Operation theatres in big modern hospitals are well-built but few are air-conditioned. We would like to remind designers that an operation theatre requires plenty of light—northern windows 60% to 75% of the floor area. It need not be large unless it is in a teaching hospital. We do not know what developments in television can be even for teaching. A large operation theatre costs more to air condition than a small one.

30. The operation theatre should be connected to at least three other rooms independently—the doctor's room with attached bath, the nurses room with attached bath and the sterilising room. It is preferable to anaesthetise the patient first in a separate room and then bring him to the theatre. After the operation, the patient may be taken to another recovery room or back to his ward for recovery. A separate recovery room in preferable.

31. The degree of protection enquired against infection varies in different hospitals, It is always preferable to install a steam disinfector for bedding, and a laundry in large hospitals. It is essential to have a steam disinfector linen, etc., a infectious diseases hospitals of any size. There should be an incinerator in the absence of a disinfector in such hospitals.

32. A mortuary and a room for cold storage of dead bodies should also be provided in all large hospitals.

33. The need for providing quarters for staff should be fully realised. No large hospital can be built without quarters for the resident medical officer, the matron, the nurses, the ward attendants, etc. Nurses have an arduous life and should be provided with good accommodation, bath-rooms and closets, a common room and a dining room.

34. The staff in the health centres should also be provided with comfortable and adequate housing accommodation, which is not ostentatious or out of tune with the standard of living of the community that they are expected to serve. Standard type designs should be worked out for those houses. Midwives, health visitors, sanitary inspectors and doctors cannot be attracted to serve in rural areas now, because, among other reasons, houses are not available in rural areas for rent and, even if available, they are not suitable. The building of modest, comfortable quarters with local materials for the staff of health centres will have an educative value in improving the standard of housing in rural areas. However, it is not advisable to waste money on building of quarters in towns where accommodation can be rented. We think that this will be possible in most towns with a population of 20,000 and above.

35. There are certain types of institutions where the patients have stay for long-periods and may be encouraged to live normal lives with a little medical care and attention. The patients will be happier if they are allowed to carry

on normal vocations and make their own arrangements about food, etc. In such cases, cottages with cooking facilities may be preferable. Leper asylums, tuberculosis sanatoria, houses for the aged and infirm, etc., may be at least partly designed on these lines. Mental hospitals may have to provide all kinds of accommodation varying from solitary cells to cottages.

36. The health centres envisaged by the Health Survey and Development Committee contemplate a unification of preventive and curative services, a clinic and an emergency cottage hospital. They have to accommodate sanitary inspectors' offices too. We saw a good and cheap building for a cottage hospital at the manganese mines at Kandri near Nagpur. A few good type designs should be prepared and followed in provinces. While we deprecate expenditure on architectural flourishes and are strongly in favour of simple, elegant utility structures, using thin internal walls and partitions, we are also emphatically against the construction of structures which will last only two or three years and which will require heavy expenditure every year on maintenance. Proposals for health centres and hospitals with thatched roofs and mud walls have to be examined critically from this point of view. Provincial Governments are not planning these buildings to tide over an emergency which will come to an end, such as war. They are planning for permanent service. We have heard of such plans for temporary buildings and desire to caution against them.

37. Those who build medical and health buildings will find it profitable to study the excellent type designs given in the pamphlet entitled "Elements of the General Hospital", reprinted by the United States Public Health Service, Hospitals Facilities Section, from HOSPITALS for May 1946, and adapt them to our local resources and needs.

CHAPTER XV

SOME ASPECTS OF ENVIRONMENTAL HYGIENE NOT COVERED IN PREVIOUS CHAPTERS

We will attempt to cover in this chapter a few items of Environmental Hygiene not already dealt with.

A. Prisons

2. We feel a little hesitation in making recommendations about prisons : We have no inside knowledge or experience of them. However, we have prepared the report of the Bihar Jail Reforms Committee (1948) and got a glimpse of environmental problems pertaining to prison life.

3. We accept the proposition that imprisonment is intended as a punishment and its deterrent value may be lost if the prison environment is brought up to the standards of the free environment. Even then, there should be no hazards to health or revolting conditions.

4. We understand that there is a standard for floor space which differs according to the healthiness or otherwise of the district in which the prison is situated. For instance, the Bihar Jail Reforms Committee considers that there should be an irreducible provision of 45 square feet per head in the jails situated in healthy districts and 60 quare feet in unhealthy districts.

5. We do not understand how such a proposal can be put forward. The healthiness of the district has little to do with the fixing of floor space which is designed to reduce chances of droplet infection from one person to another. We would recommend the universal adoption of the standard of floor space that is applicable to free individuals. There is an argument in favour of a slightly higher standard, because prisoners can be assumed to have a lower standard of personal hygiene or higher body odours on account of reduced ventilation and washing and dressing facilities. Against that we have to take note of the fact that the health of prisoners receives more medical attention than the health of free men. The minimum standard of floor space recommended by the League of Nations was 50 square feet per head. We also recommend a minimum of 50 square feet of floor space per prisoner in the wards where he sleeps, with at least six feet from centre to centre of bed.

6. We also recommend that sanitary latrines should be built in adequate numbers in prisons. We do not know how far some of the gruesome accounts of prison life are true ; but we have read that prisoners in solitary confinement have sometimes to defaecate, urinate, eat and sleep in the same cell. If true, this state of affairs should be rectified at once. If jail discipline requires that prisoners in solitary confinement should not leave their cells, a water closet or other type of facility in which the excreta will not remain exposed should be built.

7. We endorse the recommendation of the Bihar Jail Reforms Committee that prisoners should be provided with a shelter while taking their food. The prison kitchens should be designed to facilitate the preparation of food under hygiene conditions and the washing and disinfection of untensils with hot water.

8. We have no idea of the adequacy of water supply or of bathing facilities in prisons.

B. Disposal of the dead

9. We understand that people in the rural areas of Orissa throw the corpses of persons who have died of cholera, smallpox, etc., on river beds. This is an objectionable practice. We recommend that legislation should be undertaken to prohibit this. There may be some opposition on the ground of custom, but Government should not allow a dangerous offence against public health to go on out of deference to a foolish custom. Like other measures of social reform, the enactment of a law, prohibiting the throwing of corpses into rivers may remain inoperative for the first few years but we have no doubt that it will become effective later. The village officials should be empowered to incur expense of public money in cremating such unclaimed corpses if found in river beds.

10. It is desirable to build a small room or shed in cremation grounds and burial grounds for registration of cause of death, even in small towns.

11. We recommend the construction of waiting sheds and bathing ghats, platforms or enclosures separately for men and women in the cremation grounds of all towns within a population of over 50,000. A piped water supply should be provided in these bathing enclosures, if available.

12. We recommend the construction of gas or electrical crematoria in large cities.

C. Barber shops and saloons

13. These are potential sources of transmission of skin and other diseases. It is necessary to exercise strict control over their operation.

14. There should be a suitable provision for the disinfection of razors, brushes, scissors, clippers, etc., by heat or in hot water.

15. The chairs, etc., in the barber shops should be sprayed with D.D.T. or otherwise disinfected at least once in every two months.

16. The shavings, hairs, etc., should not be dumped in public parks and streets. They should be disposed of withut flying about. Shaving on street pavements should be prohibited everywhere, except in fairs, melas and places of pilgrimage where such prohibition may be impractical though necessary.

17. The use of the same towel for more than one person is unhygienic. However, we realise that it will be difficult to raise the standard of hygiene in barber shops and saloons by making rules alone. The standard of hygiene will be what the patrons demand, no more and no less. Like municipal bye-laws about cattlesheds, by-laws about barber shops will also remain a dead letter.

D. Dhoby ghats

18. We have noticed that clothes are washed by dhobies in very dirty water and even in sullage drains. The ironing may be imperfect and there are many chances of infections being transmitted by such a dangerous practice.

19. We recommend that municipalities with a population of over 50,000 should build model dhobi-khanas with a supply of clean water and should prohibit public laundering at places other than these. The model municipal laundries should be designed to boil the clothes in a pot over an oven, wash them in clea n water and iron them. Each launderer should be registered and should be given a place on rent.

20. The disposal of the waste from laundries is a problem to be faced and solved. The recommendation applicable to other industrial wastes are applicable here also.

E. Disinfection stations

21. Municipal disinfection stations should be built in all cities for disinfection of clothing, bedding, etc. These are necessary for control over the spread of infection in epidemics. In the case of adjacent municipalities, a common station will do.

22. Such stations are necessary in all major ports and in all large infectious diseases hospitals and in quarantine stations.

23. The principles of design of such station are well-known. There should be no chance of short-circuiting the infected end of the station with the disinfected end. Materials should be in circulation. Different kinds of disinfectors should be used for different materials.

F. Plumbing

24. The hazards to public health on account of contamination of public water supplies by faulty plumbing are well-known. The trade of plumbing should be licensed and the professional training of plumbers should be organised on a sound basis.

25. The plumbing regulations in our municipalities are somewhat obsolete. They require revision in the light of modern practices. For instance, the plumbing bye-laws of many cities disallow the placing of soil pipes inside a house and the carrying of excreta and waste in one pipe, although such practices are allowed in the West. Till they are revised, the bye-laws should be applied with discretion.

26. On the other hand, the inter-connection of private and public water supplies and the provision of submersible inlets to open cisterns of water, etc., are not only tolerated but even carried out by some municipalities.

27. The testing of the plumbing of a house by the " Smoke test ", etc., is rarely, if ever, carried out in the municipalities.

28. For all these reasons, plumbing rules in our country have to be modernised and enforced more rigorously.

CHAPTER XVI
CONSTRUCTIONAL MATERIALS

We have hitherto considered environmental hygiene in various aspects and made certain recommendations involving a modest short-term plan of construction or improvement, a long-term objective, optimum and minimum technical standards and administrative measures that may be adopted to work up to these standards and carry out the plan.

2. The implementation of the plan of construction will depend on the availability of materials, men and money. Acute shortage of materials is now the most serious handicap. The production in the country is insufficient for our requirements even if conditions had remained as they were before to war. That production is now shared for many projects. We cannot look for relief to imports from other countries, as we have been consuming our reserve of foreign exchange rapidly on imported food and have to cut down other imports to the barest minimum. Further, few countries other than the U. S. A. have sufficient production capacity to leave a surplus over their domestic requirements. We have very limited dollar resources to pay for imports from the U. S. A. and the devaluation of the rupee in terms of the dollar has made it all the more necessary to cut down such imports. All these factors tend to inflate the prices of constructional materials which are in such short supply.

3. Therefore, the first step that Government should take for the implementation of our plans is to review the production of constructional materials against our requirements and to adjust industrial policy with a view to increasing production of essential materials for attaining a measure of national self-sufficiency. Existing production should be controlled and allocated more equitably with due recognition of the extreme urgency of some of our plans for

housing, water supply, malaria control, etc., and at the same time plans should be vigorously implemented for setting up new factories to attain the targets of production by private enterprise with or without State aid and by State enterprise within three years. The urgency of our plans is such that they will not admit of longer delay.

4. The available foreign exchange resources of Government should be conserved for importing the capital equipment required for setting up these factories and for importing those articles that cannot be produced in India.

5. We will now proceed to detail our requirements.

Bricks

6. We have planned for a very modest programme of construction of about 560,000 houses (or family units) per annum, for a period of five years, mostly in urban areas. The minimum house with 250 square feet of floor area will require at least 12,000 standard bricks 2-3/4 inch thick.

7. It may be that in some parts of the country bricks are not used and other materials (such as stone, bamboo and mud, hollow cement blocks or prefabs) are used. However, all houses are not of the minimum size. Further there are industrial and other projects going on. We will not be far wrong in estimating our requirements of bricks at 6,800 to 10,000 millions per annum (valued at about Rs. 30 to Rs. 40 crores at present-day prices). We have no idea of the quantities produced now. This is a most important industry, in which production can be increased and cost of production can be reduced by using machines for moulding and by integration or combine of very small manufacturies.

Coal

8. Another important point is that about two million tons of slack coal are necessary for manufacture of 10,000 million bricks. It is essential to reserve at least this quantity for brick-making out of the total annual production of about 30 million tons of coal in India.

9. The quota of slack coal reserved for brick-making should be allocated to the different provinces approximately as indicated in sub-section D of Chapter III, which is reproduced below for convenience.

	%
West Bengal	21·0
Madras	11·0
Bombay	14·0
Assam	1·5
Orissa	1·0
Central Provinces	4·0
Bihar	4·5
United Provinces	16·0
Delhi	5·0
East Punjab	11·0
Mysore State	3·5
Hyderabad State	3·5
Other Staes	4·0
Total	100·0

Lime

10. On a basis of computation similar to that for bricks, the lime required is about three tons per house or about 1·7 million tons per annum for housing alone, apart from other requirements. We have not been able to get any figures about lime production in the country, but we know of many places where lime is more expensive than cement. We recommend the following targets of annual production, namely about 3·5 to 4 million tons of lime-stone to be quarried including the requirements of the cement industry, dams, etc., bleaching powder etc., and about 1·7 million tons of lime to be produced for building purposes. The coal required for burning this quantity of lime should also be reserved, in addition to the quantity required for brick-making.

Cement

11. The most modest house, having only 250 square feet of floor space, will require at least 16 bags of cement. The prefabs of Dr. Koenigsbergor, Director of Housing, Ministry of Health, New Delhi, require 25 bags of cement, *vide* Journal of the Institution of Engineers (India), Volume 29, No. 4, June 1949 (pages 94-97). Cement block construction, stabilised soil construction, etc., involve the use of 35 to 45 bags of cement per house of 250 square feet. We will not be far wrong in assuming that on an average about 30 bags or 1½ tons of cement will be consumed per house of the lowest type, over and above the lime or mud that may be used.

12. To implement a programme of construction of 560,000 new houses per annum we need 1·12 to 1·5 million tons of cement per annum and to build water-works, sewage-works, a few municipal works, etc., we require an additional 50,000 to 75,000 tons of cement per annum, apart from the requirements of industrial, power, irrigation, bridge and road projects.

13. We do not know what the requirements of these are. We will hazard a guess that the projects actually in hand will consume about 0·8 to 1 million tons of cement per annum. The present production of cement is only 1·4 to 1·5 million tons per annum although the installed capacity is said to be 2·115 million tons. We recommend that steps should be taken immediately to raise the production of cement in existing factories to at least two million tons, and that additional factories should be built for supply of about 500,000 tons of cement per annum for irrigation projects. So long as the production is only below 1·5 million tons per annum, at least 25% of the production should be allotted for housing construction and 5% for other public health engineering works, such as water supplies, sewerage, markets, etc. When the production increases, the allocation should be increased to 1·2 million tons per annum. Import of foreign cement may be resorted to for urgent needs ; but, as its price today varying from Rs. 125 to Rs. 150 per ton, it is not likely to facilitate quicker implementation of plans.

14. If the cement industry is to attain its full production capacity of 2·115 million tons, it will have to be allotted at least 600,000 tons of coal per annum distributed *pro rata* according to the output of the factory. Thus, supply and transport of at least three million tons of coal will have to be assured for brick making, lime burning and cement production to afford relief in housing, etc., as suggested by us.

Iron and Steel

15. The amount of wrought iron and mild steel required for a house may vary within wide limits. Reinforcement may be cut down to the very minimum ; but steel has to be used where it is cheaper than wood for the same structural strength and for windows, etc., for security. It has also to be used for door and window fittings. In these circumstances the quantity of iron and steel may be estimated at about $2\frac{1}{4}$ lbs. per square feet of floor space, or about 5 cwts. per house. To build 560,000 houses per annum according to our plan, the production and allotment of small round bars, square bars, flats, corrugated and plain black and galvanised sheets and rolled steel beams up to 12″×5″ should be assured to the extent of 140,000 to 200,000 tons per annum.

16. An idea of the actual allotment of steel for the second and third quarters of 1949 for housing can be had from the following extract from the statement given on page 65 of the Ministry of Industry and Supply quarterly bulletin, Vol. II, No. 1.

	Allotment for period II/49 Tons	Allotment for period III/49 Tons
Government sponsored housing schemes	1,500	3,338
Refugee housing	4,015	4,000
Provinces	12,701	12,785
States	3,160	3,595

Even assuming that 50% of the allotment to provinces and states is used in housing, only about 55,000 tons per annum is available to meet housing demand.

17. The total production in India is about 850,000 tons. We recognise that railways, industries and projects require the bulk of the steel. We do not know what their requirements are, but we would emphasise that at least 140,000 tons of steel should be exclusively allotted for public needs of housing, excluding the needs of factories, water works, sewage works, etc.

18. The above allotment will not be sufficient if metal windows are manufactured to any appreciable extent to reduce cost. Already we find that steel furniture is rapidly replacing wooden furniture on account of the high price of timber. If a considerable portion of the 140,000 tons of steel is diverted for steel furniture, it will not be possible to build houses. We do not, however, suggest that making of steel furniture or steel windows should be discouraged.

19. There will also be a steep rise in demand for pig iron to step up production of cast-iron pipes to about 150,000 tons per annum as detailed in the Chapter on water supply.

20. For all these reasons, we recommend the very early implementation of plans of Government to set up two new factories to increase the production of iron and steel by one million ton per annum.

Doors and Windows

21. As we have suggested earlier, there is room for considerable reduction in the cost of doors and windows by standardisation and mass production. Our short-term plans will require about 14 million square feet of windows and about 20 million square feet of doors per annum. This is an industry of very considerable size, in which there is plenty of room for small and large enterprise and for the improvements indicated above. The manufacture of steel windows may also be encouraged.

Timber, tiles and other roofing Materials

22. We are not in a position to give any idea of the quantity required or the quantity that is produced in the country. The cost of good quality teak is prohibitive. However, other varieties of timber can be used and we do not think there will be any special difficulties about increasing the production of those materials to requirements.

Cast-iron pipes

23. In the chapter on water supplies (Chapter V. paras 48-52) we have indicated the very serious shortage of cast-iron pipes. The foundry capacity in the country is quite insufficient. The production of cast-iron pipes in India is only of the order of 24,000 tons per annum, out of a total of 272,454 tons of iron castings. We make no apology for repeating our recommendation that new pipe foundries should be installed as early as possible and that the production of cast-iron pipes and specials alone should be raised to 150,000 tons per annum. Otherwise, all water-supply schemes will have to be shelved indefinitely.

Galvanised iron and wrought-iron pipes

24. These are not produced at all in India.

25. These are required for rural and urban water supplies, for tube-wells for making and repairing boilers, for gas supply and for many other purposes in industry. We consider it a matter of extreme urgency to establish tube mills in India to produce about 20,000 tons per annum. This quantity can be consumed easily in the country. The price of these pipes is now 300% of pre-war prices and reached the fantastic figure of over 1,000% during the war.

26. We also recommend the establishment of a factory for turning out steel pipes to the extent of about 20,000 tons a year. Such pipes will be required for the larger projects and will be easier and cheaper to transport than cast-iron pipes.

Ceramics

27. The production of stone-ware pipes in India is only of the order of 14,000 tons per annum, while we will require at least 36,000 tons to carry out the plan for extending sewerage to cities with a population of over 100,000 and to permanent pilgrim centres and for completing the sewerage in partially sewered towns. New factories should therefore be established at two or three places. Allowing for the need for sanitary fittings, the capacity of factories for producing ceramics should be stepped up from the present figure of 23,000 to 50,000 tons.

Chlorine

28 Among chemicals, the need for increasing the production of *chlorine* is most urgent. It is required for disinfection of water and sewage, for manufacture of D. D. T. and about 1,500 tons for the other purposes mentioned. Hence the production should be stepped up to 3,500 to 4,000 tons per annum as early as possible.

29. The history of the chlorine industry in America reveals an ever-increasing consumption. It rose from 6,000 tons per annum in 1914 to 485,000 tons in 1940 and is over a million tons now. If we increase chlorine production in India, we have no doubt that we will be able to use all of it.

Alum

30. We have also suggested (Chapter V, para. 56) increase of alum production from about 6,000 tons per annum to about 12,000 tons per annum for water purification in large supplies. This requires a revision of our requirements of sulphuric acid.

D. D. T.

31. We have explained at length (Chapter XIII, paras 2-17) the imperative need for establishing a factory to produce at least 3,000 tons of D. D. T. per annum to enable the nation to fight rural malaria, plague, etc., and for general desinfestation work without taking any risk attached to dependence on outside sources of supply. The production of D. D. T. requires a proper organisation of the supply of the raw materials, *viz.*, chlorine, benzene, sulphuric acid and alcohol. Such an industry should be properly integrated with other industries such as cooking, steel making and heavy chemicals. It cannot be planned in isolation.

Other Chemicals

32. We will also require increase in production of ferrous sulphate, copper sulphate, ammonium sulphate or chloride, activated charcoal, zeolite, etc. (Chapter V, para. 57). Most of these can be produced as by-products of other established industries.

Planning for production

33. The increase in production of materials as outlined above is therefore a pre-requisite for the implementation of plans drawn up by us. If the rate of production is reduced, our plans will have to be spread over a longer period.

34. The programme outlined by us can be commenced immediately after making arrangements for more reasonable and liberal allocation of existing production for improving environmental hygiene and can be accelerated when arrangements for increased production mature in the course of two or three years.

35. We have had the benefit of hearing the sound views of Dr. G. Sankaran of the All-India Institute of Hygiene and Public Health, Calcutta, on integrated planning of industrial production for nutrition and health. A report of his interview is appended (Appendix V). The Central Ministry of Industry

and Supply should be asked to integrate the requirements outlined by us with others and to take immediate steps to organise production by private, public and State enterprise. Specialists in particular fields are likely to lose sight of the possibilities of integrated production and consumption, and we consider that the right people should be entrusted with the responsibility for industrial planning. Having planned, they should be given facilities and made to bring the factories into production within three or four years.

Transport

36. Lastly there is also the big bottleneck of transport. After travelling round the country we were struck by the general inability to get a move on with plants and materials. More railway wagons and locomotives are needed urgently to move these materials from the factory to consumer, though the position is a great deal better now than it was a year ago.

CHAPTER XVII

ORGANISATION AND ADMINISTRATION

We have dealt with the various aspects of environmental hygiene in the previous chapters and drawn up a plan, for the implementation of which we have suggested a period of three years to produce materials and five years for construction. We are aware of the fact that recommendations of Committees like ours may not ordinarily be given effect to *in toto* by Government. It is possible that only some of our recommendations may be given effect to at first and that the period of construction may be prolonged on account of lack of materials, money or men. It is essential that there should be a strong technical organisation, whose special responsibility will be to ensure that the recommendations are carried out and which will be constantly at work to make use of every opportunity to improve environmental hygiene. We regret to find that such an organization is not found now in the Central Government and in many of the provinces. At present, environmental hygiene does not, seem to be the responsibility of any single department. It has been cut up into bits and given to different ministries and departments. There is no unity of purpose in the activities of these departments. Indeed, they work sometimes at cross purposes. There are town planners, public works engineers, health officers, sanitary inspectors, municipal engineers and malariologists, each working in his groove and criticising the rest, without co-ordination or common purpose. This is ruinous.

2. The plans for environmental hygiene that we have detailed in the foregoing chapters can be implemented only by engineering methods directed towards the public health objective. In other words, they are the special field of the public health engineer. The medical health officer is aware of the objective, but is not well versed in the techniques which are essentially of an engineering nature. He is, therefore, unsuitable for taking on responsibilities for environmental hygiene though his criticisms will be helpful, if constructive. The public works engineer may be a master of engineering technique but, if he is not well informed in the fundamentals of public health he cannot realise

what the objective is and cannot employ his technique purposefully. That is how he fails and why he is criticised so bitterly by the medical health officer. The town planner takes interest in all aspects of civic life, and health is naturally subordinated to other objectives. He is interested in transport, utilisation of land, etc., without any special emphasis on health. We do not think that he can be entrusted with the responsibility for environmental hygiene. A public health engineer is therefore the right person to take charge of environmental hygiene.

3. The main theme of the Health Survey and Development Committee's recommendations is the unification of medical relief and preventive medicine ; and both are called health services. The first is the means of recovering health, and the second the means of maintaining it.

4. The maintenance of health depends on personal health services, which the medical health officer alone is competent to give, and on the impersonal health services (or environmental hygiene), which the public health engineer alone is competent to render. Both are essential and both should be organised and co-ordinated in every province and at the Centre.

5. We will now consider the place that the public health engineering department should occupy in the general set-up of administrative services in the country. Public health is the objective and engineering the technique or method of this service.

6. The Health Survey and Development Committee has suggested that the public health engineering department should be organised in the Ministry of Health as a sub-department under the medical administration of health services at every level-at the Centre, at provincial headquarters, in districts and in their proposed secondary health centres. We have also heard Inspectors General of Civil Hosiptals, Directors of Health Services and health officers say in their interview with us that the public health engineers should be placed under them.

7. We agree with the Health Survey and Development Committee that the public health engineering department should be in the Ministry of Health.

8. We do not agree, however, with that Committee and with the Directors of Health Serivces, etc., that public health engineering department should be only a sub-department under the medical administration of health services. While doctors might have had reasons to be dissatisfied with the work of engineers, we are unable to accept this proposal. We are for co-ordination, but not for subordination at any level. Subordination is likely to lead only to perpetual friction and frustration. If the prospects of the public health engineer are decided on the basis of his subordination to the medical health officer and not on the emoluments of other engineers of comparable professional attainments he is bound to become an unhappy and inefficient public servant. Integration of personal and impersonal health services should not be carried to the extent of subordinating one to the other. The medical and engineering professions concerned in the promotion of public health should work as equals in co-ordination as a team with genuine respect for each other. Subordination will kill that respect.

9. Neither do we advocate the placing of the public health engineering department in a position subordinate to the Chief Engineer for Public Works or Irrigation, because in that caste the health objective is likely to be lost sight of. Even though both are engineers, the administrative superior generally has his way without regard to the considered expert views of his subordinate He is enabled to do so in view of his higher position and emoluments. This is detrimental to public interest. The Chief Engineers whom we interviewed have themselves suggested that public health engineering may be formed into an independent department like irrigation, highways, electricity, etc.

10. We do not advocate the placing of the public health engineering department in the Ministry of Local Self Government, although a good deal of the work of that department may be carried out in municipalities and local bodies. If there is a separate Ministry of Health, it will give greater emphasis to health problems and environmental hygiene is likely to receive better attention and better co-ordination with other health services by being placed under that Ministry.

11. The responsibility for design, execution and maintenance of works has been the tradition of the civil engineering profession in India in all other fields and we recommend that the same procedure should be followed in respect of water supplies, urban and rural, in respect of sewerage and sewage disposal and in respect of collection and disposal of refuse and excreta under the direction of a competent public health engineer. The medical health officer will belong to the same Ministry and his advice and helpful criticism will be available but he should not be saddled with the responsibility for performing functions for which a public health engineer is more suited.

12. It will not be possible to attract capable engineers to public health engineering if the highest post open to them in the Ministry of Health is only that of a Deputy Director, while in other fields of engineering they can become the heads of their departments. No one has suggested that the Chief Engineer for Irrigation should be placed under the Director of Agriculture, though irrigation is meant only to promote agriculture. There are precedents for more than one department being placed under the same Ministry and being co-ordinated through the Secretary to Government. Thus Highways, Irrigation and buildings are separate departments with their Chief Engineers, the Secretary to the same Ministry co-ordinating their activities smoothly and effectively in certain provinces like Madras. The Irrigation Chief Engineer is under the Ministry of Agriculture in Ceylon not under the Director of Agriculture. In the Central Government, the Ministry of Works, Mines and Power has got a Chief Inspector of Mines Chief Engineer for Irrigation, a Chief Engineer for Buildings and a Chairman, Central Technical Power Board, all holding equal positions; their activities are co-ordinated through the Secretary to the Ministry.

13. We recommend that public health engineering should from a separate self-sufficient organisation in the Ministry of Health both at the Centre and in the provinces, like the medical health organisation, but not under it maintaining the closest co-ordination with it at all levels, but no subordination at any level.

14. We recommend that, at the centre, Government should have a permanent planning organisation to co-ordinate all departmental plans at Secretariat level on the basis of the advice of their technical experts. Before proposals are submitted to the Standing Finance Committee, the approval and recommendation of experts should be obtained. This should be a necessary condition for the Standing Finance Committee to approve a scheme of expenditure. In order to give expert advice on proposals pertaining to environmental hygiene, we recommend the creation of a post of Consulting Public Helath Engineer in the Ministry of Health at the Centre. He will not have executive functions and should be attached to the Ministry of Health in the same manner as the Educational Adviser is attached to the Ministry of Education and the various advisers are attached to the Ministry of Agriculture. It will be his duty to see that the proposals are technically sound, feasible and necessary and, after the grant is made, to ensure that it will be spent for the purpose for which it was given. He should also see that factories are built to ensure supply of materials for works of environmental hygiene. He should take up such proposals with the Ministry of Industry and supply and see that his plans are incorporated as part and parcel of their plans or he should arrange for the Ministry of Health itself to take the necessary action in the matter. He should also ensure the attainment of certain standards in housing, water supply, disposal of excreta, etc., in all works for which the Central Government may contribute a portion of the cost, and to promote the implementation of the plans we have set forth.

15. It will be the sole interest of the Consulting Public Health Engineer to promote environmental hygiene throughout India, to contact, advise and influence provincial public health engineers, to serve on Committees with other engineers in the Railway Board, the Ministry of Labour the Central Waterpower, Irrigation and Navigation Commission and other departments and to remind them of public health requirements so that they may not be lost sight of in engineering projects. He will be expected to consult other experts in their respective fields—perhaps a panel of consulting engineers —when very important decisions have to be taken on any project. He will also collect and exchange technical information on public health engineering and promote research on problems in this field.

16. In the provinces, there should be a Chief Public Health Engineer in the Ministry of Health. He will have both advisory and executive functions in all aspects of environmental hygiene. He should have his headquarters staff for design, investigation, research, etc., and his executive field staff for constructions and inspections. It is difficult for us to say how many circle engineers he should have, as this depends on the volume of work. In the beginning, we think a circle engineer for three or four districts and a district engineer for each district should be sufficient. It is essential that public health circle engineers should be specially trained and that promotions from the grade of district engineers should be made only after they quality as public health engineers.

17. We understand that in certain provinces in India the public health engineering department undertakes schemes for electrification of towns also.

While granting that electrification has sometimes proved helpful in augmenting local revenues and in preparing the ground for introduction of piped water supply and sewerage, we are of opinion that, in future, public health engineers should leave electrical undertakings to departments that may be set up for that specific purpose and concentrate on works more directly related to public health. On the other hand, we understand that in certain other provinces there is a staff of building inspectors and town-planning assistants working in municipalities independently of municipal engineers and the public health engineers of the province. Such splitting of public health engineering functions is also undesirable.

18. The district engineers and circle engineers may be technical advisers in public health engineering to rural panchayats and take all necessary steps to ensure that the hygiene of the environment is improved in the best possible manner with their available resources wherever panchayats show interest in such work.

19. We recommend that the closest co-ordination should be maintained between the public engineering staff and the medical health staff, *inter alia*, in the control of spidemice, in the management of fairs and festivals large control operations in respect of diseases like malaria, plague, cholera, etc.

20. The emoluments of the staff of the public health engineering department that we envisage should be comparable with, and never less than those of their counterparts in the public works and other engineering departments. The Chief Public Health Engineer should rank in pay and status as a Chief Engineer of any other Department, circle engineers should rank at least as executive engineers in small provinces and as superintending engineers in large provinces, and so on. The initial salaries for public health Engineers and Health Officers and other technical men should be fixed at least four or five stages above the initial pay in the scales for corresponding administrative posts, when rational and unified scale of salaries is adopted, in recognition of the fact that they have to spend at least four to five years in specialised training. Good men cannot be attracted to careers in public health engineering if they find that their prospects would be better if they joined that Public Works Department, Irrigation Department, Railways, etc., without having to acquire post-graduate qualification or to specialise in public health engineering. The ambitions of many public health engineers occupying key positions have been frustrated and they are working in unappreciative atmospheres. They would not command their calling to young men under the conditions prevailing now. We, therefore, urge that Government should do justice to them and pay them at least as well as their counterparts in other engineering departments.

21. In this connection, we understand that a proposal is under consideration to recruit a public health engineer in the Central Ministry of Health on the status of an Executive Engineer. This is absurd. The duties of this officer have been detailed in paras 14 and 15 above. He should have a status in his profession and in the administrative set up, experience and capacity leadership, which will enable him to mould the pattern of development in environmental hygiene in the whole country ; to discuss professional problems

with other civil Engineers, heads of departments and Secretaries to Government; and to influence policy. We cannot understand how a first-rate man can be attracted to such a third-rate post. If a third-rate man is appointed we cannot see how he can discharge first-rate functions.

22. We have considered a suggestion that the public health engineering service should be organised as a social service and that the staff should be provided with free quarters and other amenities and a subsistence allowance which is lower in cash value than the market value of engineers in other departments. In our opinion, it is impractical and idealistic to organise a service on this basis. All opeople are not capable of self-sacrifice, and altruism of that order. There is the danger that a few of the men who are so recruited may fall short of ideals and demoralise the whole service. Further, we cannot understand the grounds on which the country can demand sacrifice of emoluments from a particular class of public servants alone, leaving others untouched. There is also another objection to such a proposal. The grant of a definite pay to an officer is a limited liability which can be discharged by Government. But the so-called free privileges like housing or free education for the children of the public health engineer, etc., are unlimited liabilities, the full implication of which cannot be foreseen. Unless all services are organised on a socialistic basis, it would be invidious to choose public health engineers alone for this special treatment, weather it is considered a privilege or a penalisation.

23. We have recommended elsewhere (Chap. V, para. 66) the provincialisation of municipal engineers. We consider this an urgent necessity. The bulk of the work of a municipal engineer is environmental hygiene. He has to maintain the water supply, the drainage system and the sewage disposal plant. He has to build markets. He examines building applications, etc., except in some very large cities. It is true that he has to maintain roads, etc., but this is comparatively minor function in the smaller municipalities. A competent public health engineer in a municipality can, as we have suggested elsewhere (Chap. VI, para. 89), take charge of public cleansing, control of the construction of restaurants, theatres, etc., and relieve the health officer for personal health services for which he is trained. We recommend that the Chief Public Health Engineer should assign members of his department as municipal engineers, just as the Director of Health Services assigns health officers to municipalities. This will result in better efficiency and better technical control over the municipal engineers. This arrangement will encourage them to be progressive in their professional knowledge and outlook and to deserve promotion to senior posts. They will also benefit by transfers which will give them a variety of experience. The sanitary inspector can continue to work under the health officer and refer important questions on environmental hygiene to the municipal public health engineer.

24. Municipal engineers and district circle engineers should also be enabled to interchange places now and then, so that they may develop a wide outlook and be enriched by a variety of experience.

25. When a municipal engineer is posted to a municipality by the Chief Public Engineer, he should be under the administrative control of the executive officer of the municipality though he will also have the right to express

his views on technical matters and refer technical questions to the Chief Public Health Engineer whenever he considers it necessary. His emoluments should depend on his status in the provincial cadre, and not on the municipality he serves. The municipality may be required to pay a fixed contribution to the Provincial Government towards his emoluments.

26. It is also necessary to provincialise the water-works operators and sewage works operators, to place them under the Chief Public Health Engineer and to give them a chance of transfer or promotion, so that they may develop a width of outlook and depth of technical competence not confined to the immediate requirements of the works they are looking after. However, we would advise that these operators, whether laboratory men or engineers etc., should not be transferred so frequently from one station to another that they cannot develop sufficient interest in the peculiar features of any one plant.

27. If practising public health engineers, town planners, consulting engineers, etc., are ready to undertake the investigation, design or execution of any work, they should be encouraged to do so, subject to scrutiny and approval by the Chief Public Health Engineer of a province or the Consulting Public Health Engineer at the Centre. This will relieve the public health engineering department of the necessary of having to do everything themselves and will also encourage the development of the profession on the right lines.

28. A comprehensive Public Health Act should be passed in every province, incorporating the technical standards and embracing all the phases of environmental hygiene that we have covered in the previous chapters.

29. We also recommend the enactment of necessary legislation to ensure that municipalities, unions and panchayats perform certain elementary functions of environmental hygiene (such as the regulation of building activities the provision and maintenance of water supply, public cleaning and conservancy, disposal of excreta, and the sanitation of food establishments, dairies, etc.) to standards prescribed by the Ministry of Health and that, when they fail to do so, the Ministry is empowered to undertake forthwith the necessary improvements at the cost of the local body concerned.

30. However, we are aware that many local bodies cannot afford to discharge these elementary functions statisfactorily with their present revenues. A revenue of Rs. 13/- per capita per annum will be necessary to maintain water supply, sewrage system, collection and disposal of refuse, roads and lighting, to render personal health services including mosquito control and to provide a sinking fund for amortization in 30 years of a capital outlay of Rs. 100/- per capital on municipal works. The actual revenues of many local bodies are only Rs. 3/- per capita. It is beyond our province to go into the question of their finances, but we have felt that an authoritative enquiry to find out practical ways and means of augmenting these revenues is necessary so that local bodies may be able to discharge their functions efficiently. We are glad to note that the Central Ministry of Health has recently set up a Committee

(*i.e.*, the Local Finance Enquiry Committee) with the following terms of reference :—

"To enquire into the question of the finances of local bodies and to make recommendations for the improvement of local finance and for that purpose—

(1) to examine whether the existing resources are adequate for the performance of the functions assigned to the local bodies and consider whether and, if so, what further sources of revenues should be provided ;

(2) to examine the methods of government assistance to local bodies and

(3) to examine the existing machinery and methods of (*i*) assessment and (*ii*) collection of taxes."

We hope that the recommendations of that Committee will receive due consideration by Government. Unless the finances of local bodies are increased, they cannot improve environmental hygiene.

CHAPTER XVIII

TRAINING OF PERSONNEL

The public health engineering service that has been proposed in the last chapter can be an effective instrument for rendering service and can produce results if qualified personnel is appointed at least to the senior posts. Hence, the organisation of training is of the utmost importance. However, the utilisation of trained personnel should not lag behind training. If it does, there will be wastage of talent, frustration and discredit to the courses of training.

2. In the training of personnel for responsible positions in public health engineering, we wish to emphasise that the training should be both academic and practical. What is ingested in the lecture room is digested and assimilated only in the field. The value of experience should not be under-rated. If it is combined with academic methods of approach to problems, it is possible to develop leadership in the profession. We would therefore urge that, at least in the early stages, more opportunities should be given to people with mature experience to undergo training than to immature persons who have not made up their minds about their future career. We are not suggesting that the latter should be ignored, but preference should be given to the former in availing themselves of facilities for training that may be established. We recommend that definite percentage of foreign scholarships, etc., should be earmarked for public health engineering.

3. We have gone through the proceedings of the All-India Council for Technical Education (printed as pamphlets of the Bureau of Education in India). That Council had more than 56 members. Such a large body with a diversity of interests was somewhat at a disadvantage in considering the organisation of technical education. It has passed a series of resolutions and drawn up a list of existing facilities for technical education.

4. This Council consists mostly of potential consumers of technical personnel and few producers. The need for public health engineering is so little realised by the consumers and the demand for it is so little, that we are not surprised that it has not been even mentioned in the Council's recommendations. It has not been included at all in the scope of " Technical Education ". We do not suggest that they considered it " non-technical education. "

5. This Council, consisting of representatives of the various Departments of the Government of India, the Legislature, Provincial Governments, States, Industries, Commerce and Labour, Universities, the National Planning Committee, Institutions, etc., has not drawn up any syllabus or scheme of training for public health personnel of any category—not even of engineering. It has gone into detail only about the organisation of courses in (1) Engineering and Metallurgy, (2) Architecture and Regional Planning, (3) Commerce and Business Administration, (4) Chemical Engineering and Chemical Technology, (5) Textile Technology and (6) Applied Art.

6. The Central Government should assume responsibility for training personnel required for improving environmental hygiene. Different categories of this personnel are :—

(*a*) Public Health Engineers.
(*b*) Public Health Engineering subordinates.
(*c*) Town Planners.
(*d*) Plant Operators.
(*e*) Medical Health Officers.
(*f*) Santitary Inspectors.
(*g*) Specialists in Public Health Chemistry, Biology, etc.
(*h*) Industrial Hygienists.

The training of high-grade personnel should be the responsibility of the Central Government for at least ten years to ensure uniformity of standards.

A. Public Health Engineers

7. Public health engineers should be basically engineers, with a sound theoretical background in engineering. We would prefer civil engineers, but in India we have many instances of engineers taking a degree in mechanical or electrical engineering and actually proving to be successful civil engineers. We will therefore not restrict the field of public health engineering to civil engineers only.

8. The specialised instruction should be divided equally between (1) the group of subjects that will give the candidate a background in health and disease and (2) the group of subjects involving the special engineering technique of public health engineering. The instruction should be both theoretical and practical. The candidate should be encouraged to be research minded. Due emphasis should be placed on laboratory techniques, experimentation, truth and care in the collection, analysis and utilisation of data, and on development of the methods of reasoning in preference to empiricism. He should be encouraged to think for himself. He should be trained in design, construction and maintenance of works pertaining to his field.

9. The course should be taught by specialists in their subjects as far as possible. We do not think that a general lecturer or professor of Civil Engineering in an engineering college can teach all aspects of public health engineering or an ordinary doctor can teach all aspects of public health in such courses. They may be able to manage in minor courses.

10. We consider the course of training organised at the All-India Institute of Hygiene and Public Health, Calcutta, for the degree of Master of Engineering (Public Health) and the syllabus prescribed therefor suitable for training of men for senior posts. Details of this course kindly furnished to us by Prof. K. Subrahmanyan will be found in Appendix VI. It fulfils the conditions we have stated above. Engineering subjects are taught by specialist engineers, medical subjects by specialist doctors, chemistry by specialist chemists, and bacteriology and biology by specialists in those subjects who have all dovetailed their instruction in sequence in order to emphasise public health objective and to convince the student about the techniques from their various angles. A copy of the syllabus for the course including the number of hours of instruction given will be found in Appendix VI. These are more or less the same as those recommended by the Health Survey and Development Committee (Appendix 34, pages 1621-63, of their report). The course has been modelled somewhat on the lines of the Master's degree in Sanitary Engineering of the Harvard University but the special problems of India have been included and all the subjects that we have covered in our report are included. Industrial hygiene and the disposal of industrial wastes have also been included.

11. A period of practical training in works has also been made a compulsory pre-requisite for the award of the degree. We understand that there are facilities for taking 30 students in the Institute and recommend that these should be fully availed of by the Provinces, Railways, municipalities, engineering institutions and engineering departments. We would repeat that men of mature experience are more likely to profit by such training and that such men should be deputed by their employers to undergo training. After this training a few hand-picked men may be given facilities to visit other countries for short periods if they are to occupy key positions. It is not necessary to send many raw graduates to study public health engineering overseas for long periods.

12. We note, however, that engineers who are not university graduates are not eligible to join this course as the Calcutta University will not award them the Master of Engineering degree. This is unfortunate. The University may set a high value on a degree, but Government and the Federal Public Service Commission have recognised certain other qualifications as at least equivalent to degrees. For instance, the associate membership of professional institutions like the Institution of Engineers (India) or the Institution of Civil Engineers, London, are considered the hall-mark of engineers and are awarded only after the candidate has proved the attainment of a standard of theoretical knowledge equal to that of a degree-holder and, in addition, a standard of practical experience that is not demanded of the degree-holder. We, therefore recommend that the Government of India should take steps immediately to award a diploma in public health engineering to such candidates when they have successfully undergone a course equivalent to the Master of Engineering (Public

Health) course. The diploma may be awarded on the recommendation of the Faculty of the All-India Institute of Hygiene and Public Health, Calcutta. The Government diploma should be recognised as being equivalent to the degree for recruitment to the services. The need for public health engineers is great and we would deprecate the raising of any barriers against those who, though not in possession of a degree, have proved to be really good engineers and are keen to undergo this specialised training.

13. The Health Survey and Development Committee has recommended the institution of similar courses in four or five other centres in the engineering colleges in the country. When the demand for public health engineers increases as a result of the implementation of the plans that we have outlined, other centres should certainly be opened. Perhaps engineering colleges will be suitable, but the service of distinguished teachers of public health, sanitary chemistry, sanitary biology, sanitary bacteriology, epidemiology and statistics should be ensured. If there are three or four engineering colleges in a province, all of them need not have such a course. We would advise caution so that mass production under poor training facilities may be guarded against.

14. We have seen the report of the Sub-Committee of the Public Health Engineering Education Committee of the University of Madras, recommending the institution of a four-year graduate course in public health engineering. The syllabus proposed for this course has also been studied by us. It lightens geometrical drawing in the first year ; abolishes machine design and drawing in the second year, does away with railway, irrigation and highway engineering and surveying the third year in the ordinary civil engineering degree course ; and introuduces public health engineering subjects partially in the third and fully in the fourth year. The syllabus in public health engineering is almost exactly the same as that detailed in the Health Survey and Development Committee's report, except that field and laboratory methods of control of water purification and sewage treatment plants have been omitted. The time devoted to malaria control, rodent control, etc., is reduced. The time allotted for field instruction and visits to plants is also apparently less.

15. Though it may be feasible to introduce public health engineering as a specialised graduate course, we feel that a pupil will assimilate a subject like public health egineering better after fully qualifying as a civil engineer so as to come to grips with it in practical experience rather than as an under-graduate. Many subjects taught in colleges do not take root in the mind of the pupil till they acquire a practical significance for him in his career.

16. Further, we do not know how quickly our recommendations will be implemented. If a large number of graduate public health engineers are produced and they are not absorbed they will be disqualified from entering the ordinary civil engineer's profession and engaging themselves in road building, railways, irrigation works, etc., for which money is being found by Governments at all times. This will be a tragedy. We do not, therefore, support specialisation in public health engineering at an early stage of the engineering degree course.

17. We feel that the degree course in engineering will be too heavy if reduced to three years from four years. The fundamentals themselves are enlarging. We are, therefore, not in favour of the recommendation of the Madras Water Supply and Drainage Committee that a specialised three-year degree course in public health engineering should be introduced in which the first 18 months will be devoted to civil engineering and the next 18 months to public health engineering. When the mind is immature and the subject new, the cramming of many subjects in a short time will be wasteful. It will not produce the man who can shoulder an important responsibility. Hygiene is taught even in high schools but its significance is rarely well understood at an early age.

18. Senior personnel in public health engineering departments and municipal engineers in municipalities of over 100,000 should be qualified public health engineers as an immediate measure.

19. We recommend the award every year for five years of three fellowships or scholarships for study abroad in public health engineering.

B. Public Health engineering sub-ordinates

20. There is a short course of three months' duration followed by three months' practical training in service for engineering subordinates who desire to qualify for a certificate in public health engineering awarded by the All-India Institute of Hygiene and Public Health, Calcutta. Here too, men of mature experience who have chosen their careers are to be deputed by Governments. We understand that the men trained so far are of this type and have proved satisfactory. Details of the syllabus and duration of instruction in each subject (Appendix VII) are approximately the same as those recommended by the Health Survey and Development Committee (Appendix 35, page 164, volume III, of their report.)

21. We have considered the recommendation made in the report of the Sub-Committee of the Public Health Engineering Education Committee of the University of Madras and in the report of the Madras Water Supply and Drainage Committee regarding the institution of a separate Licentiate Course in Public Health Engineering. If the teaching can be organised on sound lines, we have no objection to such a course. However, we have a fear that plumbing may be mistaken for public health engineering and that such a course may produce a large number Licentiates who are neither public health engineers nor good craftsmen in plumbing. The creation of one more caste in the engineering profession—the Licentiate who cannot rise to high position and who will be like the sanitary inspector—does not appeal to us. We would prefer to institute courses similar to the certificate course in the All-India Institute of Hygiene and Public Health. We would also prefer to recruit civil engineers as junior public health engineers and give them facilities to qualify as public health engineers before promoting them to senior posts, rather than appoint licentiates in public health engineering as junior public health engineers and condemn them to such a position for life.

C. Town Planners

22. The All India Board of Technical Studies in Architecture and Regional Planning has drawn an outline of curricula of studies, which has been accepted by the All-India Council for Technical Education as the basis for granting a diploma. The Delhi Polytechnic is imparting instruction in Art and Architecture to 31 students per annum and the J.J. School of Art in Bombay is imparting instruction to 10 students per annum. We do not know whether the emphasis is on planning or architecture. Apparently it is on architecture. The Board has recommended the provision of facilities for training 90 students in each of the Higher Technological Institutes proposed by them in the Eastern and Western region.

23. We are not in a position to say whether there will be a large demand for expert town planners. Probably, about 250 or 300 planners can be absorbed in the whole of India, including Government organisations, Improvement Trusts, Housing Corporations proposed by us, and private practice. The normal replacements cannot be more than 12 to 15 per annum. A single high-grade training institution may be established at the Delhi Polytechnic or some other suitable centre (*e.g.*, in Hyderabad) to give a four-year course in town planning. If town planners are produced in mass, there may be no scope for them. This institution be allowed to present candidates for a diploma to be awarded by an Institute of Town Planning. Two fellowships or scholarships may also be awarded every year for five years to enable selected candidates to undergo training in town planning in Europe and America. Before being sent abroad, these candidates should have worked for at least five years in a consulting surveyor's office or a town planner's office where planning is actually being undertaken. Study leave rules should be liberalised. The men who return after studies in foreign countries should be placed in suitable positions and made use of by Government. Otherwise, nobody need be sent abroad at Government expense.

24. However apart from specialised training in town planning, the training of the public health engineer should include a fair amount of instruction in town planning. This is likely to be more useful for improving environmental hygiene.

D. Plant operators

25. We consider it necessary to organise short refresher courses of four to eight weeks duration for existing plant operators. For those who wish to become plant operators we recommend actual apprenticeship on the plant for about six months integrated with two to four lectures and four to eight hours of laboratory work a week. The engineer type of operator should get acquainted with the laboratory procedures, which should be regarded as aids to maintaining a standard of performance and not as means of incriminating him. Similarly, the laboratory men should understand the engineering operators' point of view. We do not think it possible to organise such courses effectively everywhere. Only centres where modern water works sewage works of some complexity are available should be chosen for this purpose. There it appears to be facilities at Calcutta, Delhi and Jamshedpur and partial facilities at Bombay. The need for such courses will increase as more water and sewage works are built. It is advisable to start such a courses at Calcutta and at Bombay and to

persuade municipal and provincial authorities to depute plant operators for refresher courses for short periods. The course should be slightly different for engineers and for laboratory technicians in water and sewage laboratories.

26. We have commented in earlier chapters on the fact that laboratories in water and sewage plants are so few. They should be provided in every large plant. The money spent on plant laboratories is an insurance against inefficiency, waste and risk to public health. A single laboratory at provincial headquarters will not serve the purpose for, when samples are examined by an outside agency, the attitude of plant operators will be to escape the ensure of that agency. When samples are examined by the operators themselves, their attitude will be to improve their standard on their own initiative and not at the behest of an outsider.

E. Medical Health Officers

27. The training of health officers is now organised at Madras, Bombay and Calcutta. The last trains candidates on an all-India basis.

28. We will go into the recommendation of the Health Survey and Development Committee about the training of the basic doctor, who will be able to take up public health work without further training. The recommendation has not been accepted or given effect to in any province yet.

29. Public health engineering should be taught to medical health officers by a public health engineer. The subject should be taught in such a manner that they get an idea of the scope of modern public health engineering and develop a genuine regard for a profession which can relieve them of direct large-scale responsibility for the hygiene of the environment. It should not be taught with unnecessary details of engineering techniques for it will then become dry and uninteresting to the doctors.

F. Sanitary Inspectors

30. The Health Survey and Development Committee has recommended a syllabus for the training of sanitary inspectors (vide Appendix 36, page 16 volume III, of their report). This syllabus is suitable. The majority of sanitary inspectors are not employed on sanitation although they are trained for it. They are employed on miscellaneous duties, such as verification of vital statistics and vaccination. We consider that these inspectors can be employed more profitably in environmental hygiene.

G. Specialists in public health chemistry, biology, etc.

31. A few high-grade personnel of this sort will be required for teaching in universities and for carrying on research in public health engineering ; such personnel cannot be trained in large numbers. Facilities for research students of this class can be provided in the All-India Institute of Hygiene and Public Health, Calcutta, in the Indian Institute of Science, Bangalore etc., and in the provincial public health laboratories. Such specialists should carry on research and get training in close association with engineers and not in isolation. Fellowships should also be arranged to enable them to study in foreign counrties, particularly the United States of America.

H. Industrial hygienists

32. We have recommended elsewhere (Chapter XI, para. 15) that industrial hygiene should be developed not merely on the medical plane but also on its chemical and engineering planes. In the meantime, general instruction in industrial hygiene, industrial safety and accident prevention by engineering methods should be incorporated in the training of public health engineers and factory inspectors. We note that this is already included in the post-graduate training course for public health engineers at the All-India Institute of Hygiene and Public Health, Calcutta.

CHAPTER XIX

FINANCE

We will now deal briefly with the financial implications of the programme of development outlined in the foregoing chapters and make some suggestions about ways and means of raising funds and assisting less favoured provinces.

2. It is not the normal function of a technical committee like ours to suggest ways and means of raising money. We can state the needs and draw up an estimate and if we succeed in convincing administrators that the proposals are necessary and feasible, it is for them to find the funds. However, our proposals should be based not only on what it intrinsically needed but also on what we can afford. We believe we have been actuated throughout by these two considerations in drawing up our proposals. They do not all involve expenditure of money. There are some proposals about organisation, etc., involving expenditure which has to be incurred first, and others which can be taken up three, four or five years later. Most of the proposals involving financial outlay are productive schemes. Direct expenditure by Government is required only for some proposals. There are many other proposals in which progress will depend upon the interest displayed in the particular improvement by the community.

A. Training

3. Training of personnel should be taken up along with the organisation of a strong public health engineering service in every province or State. It is desirable that the training of high-grade personnel should be the responsibility of the Central Government for at least ten years to ensure uniformity of standard. We have recommended in Chapter XVIII that senior personnel in public health engineering departments and municipal engineers in municipalities over 100,000 should be qualified public health engineers as an immediate measure. We estimate the number of public health engineers required on this basis as about 200. It is not likely that very senior members now in service will undergo training. Every province and State should depute every year two to four officers and two engineering subordinates to undergo training at the All-India Institute of Hyginene and Public Health, Calcutta, and to take full advantage of existing facilities. The extra cost of deputing one officer may be about Rs. 2,000/- to Rs. 2,500/- per annum. We recommend that the Central Gov-

ernment should as a gesture, meet half the extra cost incurred by a Provincial Government on account of such deputation. A provision of about Rs. 35,000/- per annum in the Central Government budget will be required for about 10 years. Each of the provinces will have to set aside about Rs. 4,000/- per annum for deputation of their officers.

4. If the response is satisfactory and the need arises for increasing the seats in the All-India institute of Hygiene and Public Health, Calcutta, the extra cost recurring may be of the order of Rs. 40,000/- per annum. If a new centre is to be opened, capital expenditure will have to be incurred on buildings and equipment besides recurring extra cost of about Rs. 80,000 per annum.

5. We have also recommended the award every fear for five years of two fellowships in town planning in foreign countries and three fellowships for study for public health engineers. These may cost Rs. 50,000/- per annum and may be borne by the Central Government.

B. Organisation

6. We have stressed the urgent necessity for a Consulting Public Health Engineer in the Ministry of Health at the Centre and given an idea of his duties in chapter XVII. Whatever may be financial provision in the budget for grants for works of envioronmental hygiene, these grants can be well spent only if there is a Consulting Public Health Engineer to scrutinise the schemes. This post should be created immediately ; it will cost about Rs. 35,000 per annum.

7. Every province should have a department of public health engineering with a Chief Public Health Engineer, staff for investigation and design, circle engineers, municipal engineers and district engineers. This can be done partly by reorganisation of the existing municipal engineers on a provincial basis and partly by additional staff. The municipalities may be required to pay to Government the money they have been spending hitherto on municipal engineers. After taking into account possible savings in the budgets of other departments as a result of reorganisation and the contribution from municipalities, we think the cost may, on an average be Rs. 200,000/- per annum in each province—the smaller provinces incurring less and the larger provinces more.

C. Materials

8. When to organisation is set up for investigation, planning execution and maintenance and materials are also made available, we can expect quick progress.

9. We have detailed in chapter XVI the steps to be taken for production and supply of materials. The first step is more liberal allocation of cement, steel, pipes, bricks and coal for housing, water supplies, drainage, etc. We have shown in that chapter how very deficient the present allocations are when viewed against requirements. The present allocation can be liberalised only by constant pressure on and contact with the authorities controlling the materials by the Central Ministry of Health through the Consulting Public Health Engineer.

10. The next step is to establish new factories for increasing the production of cement, cast-iron pipes, wrought-iron pipes, steel, chlorine, D. D. T. and alum. We are of the definite opinion that the shortage in these materials cannot be solved by temporary expedients like imports for a few months. New factories will have to be established, and foreign technical aid and even foreign capital should be encouraged to flow into our country for their establishment. Active Government aid, encouragement and support will be necessary to get them established. Plans for these factories should be made part and parcel of other highest priority plans of the Ministry of Industry and Supply. If not, the Ministry of Health should press on Government the need for these factories and have them established.

11. All factories excepting the steel plant can be erected at a cost of about Rs. 20 crores. The steel plant is expected to cost Rs. 60 crores. The investment will be productive and profitable in every case. It will not be directly connected with environmental hygiene, but is essential for it. A good deal of the capital may be found by private enterprise. The value of the articles produced in these factories every year will be several times the capital cost. We need not remind Government of their value from the point of view of national economy and national self-sufficiency.

D. Water Supply

12. Our recommendation in section 'C' of chapter V may be referred to. If well managed, investment on urban water supplies should be productive and profitable as in other countries. The organisation that we have suggested should be able to ensure their management on business lines combining efficiency with economy.

13. We have suggested an expenditure of Rs. 30 crores in five years on the provision of or imporvement to water supplies in towns of over 50,000. Of this amount we have suggested 10 % (Rs. 3 crores, in five years, or Rs. 60 lakhs per year) to be given as grant-in-aid from the Central Government. Preference may be shown to the less favoured provinces, such as Assam and Orissa by doubling the grant from the Central Government. The balance of Rs. 5·4 crores per annum may be given as loan to the provinces for such water supplies. The provinces may advance 50% of the cost of such water supplies as loans and the balance as grants.

14. We have estimated the cost of water supplies to be provided mainly for displaced persons as Rs. 18 crores, to be spent in five years, and to be shared equally between the Centre and provinces. This is an abnormal but inescapable necessity. Where a municipal water supply has to be improved partly for catering to displaced persons and partly for normal growth, the allocation of the burden between the Centre, the Provincial Government and the municipality may be decided by ascertaining the share of the estimate pertaining to displaced persons.

15. We have recommended the provision of protected water supplies in all pilgrim centres that are likely to attract 10,000 persons or more per year. We are confident that the cost of those and the cost of sewerage schemes for some of those centres can be fully financed from the proceeds of a pilgrim tax

that may be levied at about eight annas per head if it is not being levied already. We are of opinion that the proceeds of the pilgrim tax should be made available to the Ministry of Health for sanitation and health at these centres. The regular collection of such a tax at toll gates on roads leading to pilgrim centres will also provide an opportunity for checking up on the health condition and immunisation of pilgrims. We do not think people would object to such a tax if they can get better health services in return.

16. We have suggested a programme for water supplies to cholera-stricken districts, scarcity areas and demonstration health centres. A sum of Rs. 85 lakhs per annum may be spent by the Central Government for five years for such schemes and the provinces concerned may spend about Rs. 2·12 to 2·5 crores for the same period.

17. Thus our short-term proposals involve an expenditure of Rs. 5·7 crores per annum by the Central Government for five years on water supplies—of which Rs. 3·6 crores will be mainly on account of the refugee problem. Rs. 12 crores may be spent by the provinces per annum for five years on water supplies. Of this amount Rs. 3 crores may be advanced as loans to municipalities and the balance as grants. We suggest that the expenditure on the five-year plan of water supplies may be graduated approximately as indicated below. This will allow of a higher expenditure after the first two years when the production of materials, would, we expect be adequate.

Proposed Expenditure on a Five-Year Plan for water supplies.

	Central Government		Provincial Government		Local bodies borrowing from Provincial Governments
	Grants to Provinces	Loans to Provinces	Grants to Local Bodies	Loans to Local Bodies	
			(*in Lakhs*	*of Rupees*)	
1st Year	40	80	60	30	30
2nd Year	60	120	90	40	40
3rd Year	100	200	150	60	60
4th Year	150	300	220	80	80
5th Year	205	370	352	90	90
Total ..	505	1,070	872	300	300

18. If any province wishes to spread the programme over a period longer than five years, the amount that the Central Government should set apart will be reduced correspondingly.

19. We would emphasise that expenditure on water supplies and sewerage, etc., should be considered as capital expenditure, and budgetary allotments for such works should not be made out of current revenues. A province like

Assam which has a revenue of only Rs. 5 crores will not be able to do anything if it has to find money for water supplies, etc., from current revenues. The money should be voted each year as for capital works and should be put into a fund, which may be drawn on as materials and personnel become available. Although we have suggested a five year programme, it is not likely that the provinces and the Centre will be able to spend the same amount every year ; and it will defeat our purpose if the unexpended grants for water supplies, etc., lapse without being made available for the next financial year.

20. Priorities in the execution of water supplies should follow well-defined principles and should not be a concession to the most vociferous demand. Grants from the Central Government to provinces, and grants from provinces to local bodies should be made subject to the condition that the works are carried out to certain specified standards and that the agencies and supervisory personnel employed on the construction of the works are also approved.

E. Measures for hygienic collection and disposal of community wastes

21. Reference is invited to our proposals in chapter VI. We have suggested an expenditure of Rs. 15 crores in five years on sewerage of pilgrim centres and unsewered towns of over 100,000, and improvements to existing sewerage and sewage disposal plants. Of this amount, the sewerage of permanent pilgrim centres alone may cost about Rs. 4 crores ; we recommend that the Central Government should set aside funds up to Rs. 40 lakhs every year as 50% grant-in-aid to projects of Provincial Governments for sewerage of permanent pilgrim centres. The Provincial Governments may find the other 50% from funds of religious endowment boards. The cost of the maintenance of the sewerage systems may be met out of the proceeds of the pilgrim tax. The cost of sewerage projects for non-pilgrim centres may be shared equally between the Provincial Government and the local body concerned ; the proceeds of the entertainment tax in a municipality may be applied towards the municipal share of the cost of the sewerage scheme.

22. The financial burden of the rest of our recommendations in chapter, VI will not fall on the Central or Provincial Governments directly. The education and self-help of the people are the controlling factors. A provision of Rs. 1 to 2 lakhs per annum for promoting rural sanitation works in the budget of the Ministry of Health of each province will suffice in our opinion.

F. Housing and town planning

23. If housing is really put on the basis of a " public utility " by following the suggestions we have put forward in chapter III, the problem can be solved by public enterprise and the least investment of Government funds. The release of building materials will stimulate private buildings ; but, if Government arrests speculative appreciation of building sites by acquiring land and promoting housing corporations, rents will come down within the reach of the poor and the cost of building will also be reduced by rationalisation and mass production.

24. We have suggested that the target should be to build 560,000 family units per year for a period of five years. Of these 30% or 168,000 fmily units can be built by small enterprise on such plots of land, without any Government

aid other than the release of building materials. The rest (392,000 houses per annum) may be built by public utility corporations so that they may effectively play their role of bringing down rents and eliminating speculation in land value. To enable them to function, Government should acquire suitable plots for satellite towns and neighbourhood units of a total area of about 10,000 acres, in blocks of 15 to 120 acres. They may cost anything from Rs. 1,000 to Rs. 50,000 an acre, but the average value may be assumed Rs. 10,000 for estimating. Hence a non-recurring sum of Rs. ten crores may be required for acquisition of sites for satellite towns. It is immaterial whether the Central Government finances the acquisition or the Provincial Governments finance it out of their own resources. In any case, they can get a definite return of Rs. 300 to Rs. 900 per acre as ground rent—which will give them approximately a 3% return on investment. If the Central Government chooses, it can lend the money to provincial governments for acquisition of land for such purposes.

25. The housing corporations will have to make investments ranging from Rs. 25 lakhs to Rs. 2 crores each on housing projects and will get a net return of over 3½% on outlay. This return may be guaranteed by legislation in the earlier stages. This mode of investment may be suitable for the funds of insurance companies.

26. It is difficult for us to estimate how many new houses will have to be built directly by Government for refugees or for Government servants. Perhaps 2% of the total housing programme, involving an annual outlay of about Rs. 7·84 crores on about 11,000 houses in all the provinces and States put together, may be about the maximum Government can afford to undertake; we have however no doubt that the investment will be productive.

27. We have recommended in Section H of chapter III that a token grant of Rs. 4,000/- be made for water supply and other improvements (to slum or bustee). We think that a provision of Rs. 50,000 to Rs. 200,000 in the budget of each province will suffice, if the expenditure in each slum is shared equally by the Provincial Government and the municipality concerned.

G. Congregations

28. The recommendations we have made in Chapter IX regarding pilgrim centres relating to water supply, sewerage, excreta disposal and the building of infectious diseases hospitals can be financed out of a pilgrim tax and out of appropriations from religious endowment boards.

29. We have suggested that Government should themselves take up the task of bringing school buildings up to minimum standards of accommodation and collect a return of 4% on the investment. If such a policy is followed it is likely that 80% of the schools will be improved by the school authorities at their own expense and a token allocation of Rs. 50,000 to Rs. 200,000 per annum in the education budget of each Provincial Government will suffice to improve conditions in at least 500 schools in each province every year.

30. Our recommendations about places of public resort can be carried out mostly by legislation and administration and will not involve any expenditure by Government. The recommendation about disinfecting public transport vehicles can be carried out if insecticides are available in the market.

H. Pollution of streams, lakes and beaches

31. Our recommendations in Chapter X relate to methods of treatment of sewage, erection of public conveniences at bathing ghats, etc. These will not cost much. They will be included in other estimates. We have also recommended that research should be undertaken. We think that the Central Government should undertake to promote such research and should set apart Rs. 50,000 to 100,000 per annum for this work.

I. Industrial Environment

32. The most glaring defect is inadequate housing. The Central Ministry of Labour has drawn up plans for building one million workers houses in 10 years. If these plans are implemented, this will go a long way in improving the present unsatisfactory state of affairs. However, we have our doubts whether Government will be in a position to invest Rs. 40 crores a year on industrial housing alone for 10 years. If our proposals about promoting public housing corporations are carried out, the need for Government to invest Rs. 40 crores per annum on industrial housing will not arise. The other defects in the industrial environment can be improved by better administration and by building canteens, creches, latrines, etc., that will serve their purpose more effectively, as explained in Chapter XI. We do not think industry will grudge spending money on these. We are not going into the question of building hospitals for industrial workers.

J. Rural environment

33. Water supply is the most crying need of villagers. It can be provided at an average capital expenditure of Rs. 3/- per head, and a recurring expenditure of Re. -/1/- to Re. -/2/- per head, as explained in Chapter XII. If some financial wizard can suggest a way of raising this money, we will harness all the resources of public health engineering to achieve this to perfection. The proposals we have made about providing water supplies first to cholera-stricken districts and scarcity areas are only compromises with our ideal.

34. This service can be provided and maintained only by Government. If the extra money can be collected indirectly, through some tax, like irrigation cess, it will be helpful. Regarding excreta disposal, our proposal can be carried out only to the extent that the people are willing to co-operate. They can be induced and gently pressed into putting up latrines. Government should provide the tools and the technical organisation to provide the villagers with latrines. For this, we have suggested a provision of Rupees 1 to 2 lakhs per annum for rural sanitation works in the budget of the Ministry of Health in each province.

K. Control of insect and animal vectors of disease

35. We have stressed in Chapter XIII the need for providing for malaria control in all estimates for engineering projects.

36. We have recommended the construction of a factory to produce 3,000 tons of D. D. T. per annum. This is the first step to be taken. It will be a productive proposition.

37. This will enable Provincial Governments to fight rural malaria. They may have to incur expenditure for one or two years in demonstrating the benefits accruing from malaria control by D. D. T. The cost may be of the order of Rs. 2·5 crores for the whole of India, but perhaps it need not be taken up at the same time in all provinces. The Central Government may contribute one-third of the cost of a rural malaria control scheme for a maximum period of two years, if the Provincial Government will undertake to find the remaining two-thirds. After two years, we think the people can be called upon to pay a malaria tax of Re. -/8/- per head per annum and the entire cost of malaria control met from the proceeds of that tax.

38. We have not gone into the cost of a permanent anti-plague measures recommended by us. The cost will be comparatively little.

39. In conclusion, we wish to plead most earnestly for the speedy implementation of the programme by us. The present financial stringency need not act as a deterrent to the implementation of our recommendations. The beginnings will not cost much and, during the time we organise personnel and material, the economy of the country will, we hope, be based on firmer foundations than now.

CHAPTER XX

SUMMARY

(Most important items are shown in BOLD type).

Chapter I. Formation of Committee

1. Chapter I deals with the constitution of the Committee and gives its terms of reference. It also mentions the work done by other Committees on certain aspects of environmental hygiene. Mr. T. T. Krishnamachari, Member of Constituent Assembly, Standing Finance Committee and Drafting Committee of the Constitution, was co-opted as a member to advise on financial aspects regarding the implementation of our recommendations. Mr. Raman resigned in September 1949 on grounds of health.

Chapter II.—Problems

2. Chapter II sets out the complexity of the problems to be tackled regarding housing, water supply, general sanitation including conservancy and drainage, prevention of river and beach pollution, control of insect vectors of diseases, disposal of trade wastes, etc.

Chapter III.—Housing.

3. It is estimated that 2·84 million dwelling units should be built in five years to meet the housing shortage in urban areas ; of these 1 million will be for displaced persons and 1·84 million for meeting the requirements of normal increase in population. For this purpose, at least a quarter of the steel and cement production, coal, transport, etc., should be allocated for house building in the country and, at the same time, steps should be taken to increase the production of steel, cement, lime, bricks, etc. (Chap. III, para. 13, and Chap. XVI).

4. It may be natural to think of temporary structures to afford quick relief, but we consider that it is false economy for Governments and public authorities to go in for mud walls, bamboo matting and thatched roof for houses, even though their initial cost may be 1/5th or 1/4th of the cost of the conventional houses. The cheap house is suitable only under the fond care and maintenance of the rural owner. It is unjustifiable when built out of public funds. (Chap. III, para. 16).

5. Ways and means for effecting economies in building costs are discussed in paragraphs 18–23 of Chap. III.

6. The best way to meet housing shortage is to develop " satellite towns " and " neighbourhood units ", to promote self-sufficiency and mixing-up of social groups for housing populations of 10,000 to 20,000 instead of adding on the fringe of an existing town. (Chap. III, para. 26).

7. Standards of healthful living are recommended in paras. 27–30 of Chap. III. These standards should be the basis of a National Housing Code and an administrative machinery should be set up for ensuring compliance with them before and after building of or alteration to houses. (Chap. III, para. 32).

8. Minimum standards for a house in rural areas are specified in para. 33. Chap III.

9. Provision of water supply and latrines is indispensable in the practical maintenance of standards of decent living ; any one who lets a house to a family for occupation without these facilities should be punished by law: (Chap. III, para. 34).

10. A house should be built at least as a two-roomed structure apart from the kitchen, the bath, etc., according to specified standards, even if exigencies require that it should be occupied by two families till the shortage is relieved. If a single-roomed house is absolutely unavoidable, it should have a floor space in the living room of at least 200 square feet and there should be a separate kitchen of at least 50 square feet. (Chap. III, para. 34).

11. Research should be undertaken in institutions of technology and engineering to evolve new designs, materials and methods of construction with a view to promoting better fulfilment of the basic principles of healthful housing at lower costs. (Chap. III, para. 35).

12. POSITIVE PLANS FOR NEW HOUSING PARTICULARLY AS A " PUBLIC UTILITY " THROUGH THE AGENCY OF PUBLIC HOUSING CORPORATIONS ARE DETAILED IN PARAS 36-37 OF CHAP. III. IF THIS IS DONE, THE PROBLEM OF HOUSING THE LOWER-INCOME GROUPS WILL BE LARGELY SOLVED WITHOUT STRAINING THE FINANCES OF THE STATE.

13. In big cities like Calcutta, Bombay, Delhi and Madras, Government should provide quarters for at least 60% of their employees. (Chap. III, para. 51). Government should also provide accommodation for their employees in small towns of less than 10,000, where it is extremely difficult to find suitable rented accommodation. (Chap. III, para. 54).

14. Government should provide accommodation for all employees in essential services. (Chap. III, para. 55).

15. In fixing minimum rates of wages for industrial workers under the Minimum Wages Act, 1948, either a house or an allowance equivalent to the economic rent for the minimum standard house should be given. (Chap. III, para. 67).

16. Recommendations regarding the minimum standard of housing for industrial workers are given in paras. 68-69 of Chap. III.

17. Government should adopt a firm attitude with respect to industrial housing and divert the Excess Profits Tax towards solving this problem. (Chap. III, para. 75).

18. Recommendations regarding housing co-operative societies are given in paras. 76-77 of Chap. III.

19. The Central Government should enact a law of compensation to enable Provinces and Improvement Trusts to proceed with slum clearance schemes without being overwhelmed by claims for compensation. (Chap. III, para. 80).

20. New accommodation for slum dwellers must be found before a slum is cleared. In the present state of housing shortage, all slum clearance schemes should be suspended for five years—till an adequate number of new houses are built. (Chap. III, para. 82).

21. Often a place becomes a slum on account of sub-standard arrangements for water supply, drainages, latrines and refuse collection service. For the next five years, instead of going through dilatory procedures for finding the owner of a slum and compelling him to provide these amenities, THE MUNICIPALITY SHOULD BE ENABLED TO EFFECT THESE IMPROVEMENTS AT ITS EXPENSE, ONE HALF OF THE COST BEING MET FROM MUNICIPAL FUNDS AND THE OTHER HALF FROM A SPECIAL GOVERNMENT GRANT WHICH MAY BE MADE FOR THIS PURPOSE. (Chap. III, para. 83).

22. Municipalities should be vested with summary powers to carry out such improvements and recover the cost from the owner as the first charge on the property. (Chap. III, para. 84).

23. A civic survey should be conducted in respect of sub-standard houses in each urban area spread over two years. (Chap. III, para. 85).

24. In villages, the main defects in houses are the absence of latrines and water supply. The latrine should be provided by the house-owner and the water supply by Government. (Chap. III, para. 86).

Chapter IV.—Town and Village Planning.

25. Town and village planning should always precede housing. Recommendations regarding urban planning are made in paras 1—15 of Chap. IV, those regarding village planning in paras. 16—20 and those regarding regional planning in para. 21.

26. The scope, functions, etc.,of Improvement Trusts are discussed in paras. 22 and 24—30 of Chap. IV. When the improvement needed is of considerable magnitude, a small executive body like an Improvement Trust is better suited to carry it out. (Chap. IV, para. 23).

27. Those Provinces which have no Town Planning Acts should enact them immediately. Existing Acts in some Provinces are inadequate. They should be amended. (Chap. IV, para. 32).

28. The provincial Town Planner should be on the staff of the Ministry of Health as an adviser. In the practical execution of large housing projects, an engineer with knowledge of public health engineering, including town planning will be more suitable than a pure town planner to direct and execute the work (Chap. IV, para. 33).

29. Provincial Housiug Boards may be established as statutory bodies—with the Chief Public Health Engineer (suggested by us in Chap. XVII) as the Chairman, a Financial Adviser, and two or three members chosen for their administrative ability and integrity and appointed for a term of years. These Boards may be authorised to float loans at $\frac{1}{2}\%$ above the government

borrowing rates and use them for land acquisition. They may be authorised also to license public housing corporations or to engage in housing activities themselves. (Chap. IV, para. 35).

CHAPTER V.—WATER SUPPLY.

30. Only 16 % of the total number of towns in India have protected water supplies, which serve 6·15% of the total population or 48·5% of the urban population. In the rural areas and smaller urban areas the water supply continues to be as unsatisfactory as it was when the Health Survey and Development Committee reported. There is very little protection in the water supply, as it is drawn from sources open to contamination of all sorts. A survey of the existing position in respect of water supplies is given in paras 2—5 of Chap. V.

31. Plans drawn up by other Committees regarding water supply are summarised in paras. 6—8 of Chap. V.

32. RECOMMENDATIONS FOR A MODEST FIVE-YEAR PLAN IN RESPECT OF WATER SUPPLY, TAKING INTO CONSIDERATION THE URGENCY OF OTHER POST-WAR PLANS AND THE SCARCITY OF MONEY AND MATERIALS, ARE :

(A) TO INSTAL NEW WATER SUPPLIES AND IMPROVE EXISTING WATER SUPPLIES IN ALL TOWNS OF OVER 50,000 TO CHECK THE RAPID DETERIORATION OF URBAN WATER SUPPLIES AND AID THE PROGRAMME ALREADY SET OUT FOR NEW HOUSING. (para. 11).

(B) TO INSTAL PROTECTED WATER SUPPLIES IN ALL PERMANENT PROJECTS FOR THE ACCOMMODATION OF DISPLACED PERSONS. (para. 12).

(C) TO PROVIDE PROTECTED WATER SUPPLIES IN ALL PERMANENT PILGRIM CENTRES IN INDIA. (para. 13).

(D) TO PROVIDE PROTECTED WATER SUPPLIES TO AT LEAST 75% OF THE PEOPLE IN DISTRICTS WHERE CHOLERA DEATH RATES HAVE BEEN 100 OR OVER PER 100,000 PER ANNUM DURING THE LAST TEN YEARS. (para. 14).

(E) TO PROVIDE PROTECTED WATER SUPPLIES IN AREAS OF GREATER WATER SCARCITY. (para. 15).

(F) TO DEVELOP AND MAINTAIN WATER SUPPLIES IN AREAS COVERED BY HEALTH CENTRES WHERE INTENSIVE PERSONAL AND IMPERSONAL HEALTH SERVICES ARE BEING DEVELOPED. (para. 16).

IN ADDITION, WE SHOULD :

(1) ESTABLISH PLANT CONTROL LABORATORIES. (para. 18).

(2) ORGAGISE THE TRAINING OF PLANT OPERATORS (para. 19).

(3) ORGANISE PUBLIC HEALTH ENGINEERING SERVICES ON A STRONG AND SOUND BASIS IN THE HEALTH MINISTRIES AND TO ENTRUST THEM WITH THE RESPONSIBILITY FOR DESIGN, CONSTRUCTION AND MAINTENANCE OF PUBLIC HEALTH ENGINEERING WORKS (IMPERSONAL HEALTH SERVICES). (para. 17).

(4) PLAN FOR GRADUAL EXTENSION OF PROTECTED WATER SUPPLIES TO 90% OF THE POPULATION IN 40 YEARS.

33. The financial implications of this five year plan are (*vide* para 23 of Chap. V) :

(*i*) Probable expenditure by the Central Government of Rs. 5·05 crores per annum as grants-in-aid and Rs. 10·70 crores per annum as loans to Provinces.

(*ii*) Probable expenditure by Provincial Governments of Rs. 8·72 crores per annum as grants and Rs. 3·00 crores per annum as loans to municipalities—a total expenditure of Rs. 11·72 crores, out of which Rs. 10·70 crores will represent loans from the Central Government.

34. Detailed recommendations regarding standards to be adopted in the case of public water supplies are given in paras 25—47 of Chap. V.

35. The greatest handicap to the construction of water Works today is the lack of materials. Our short-term plans envisage an expenditure of about Rs. 26·00 crores a year for five years on water supplies. At least Rs. 14·00 to 18·00 crores a year will be spent on cast-iron pipes. We cannot and should not import cast-iron pipes from abroad owing to the urgent need for conserving foreign exchange. GOVERNMENT SHOULD THEREFORE TAKE IMMEDIATE STEPS TO PUT UP CAST-IRON PIPE FACTORIES OF A CAPACITY OF 12,000—15,000 TONS PER MONTH. (Chap. V, paras. 48—52).

36. The larger water works will require steel pipes. Even smaller water works may use steel pipes on account of economy and ease of transport.

ABOUT 40,000 TONS OF STEEL PIPES PER ANNUM CAN BE CONSUMED FOR WATER SUPPLIES. PRODUCTION OF STEEL SHEETS AND MANUFACTURE OF STEEL PIPES SHOULD BE PROMOTED BY GOVERNMENT ON THIS BASIS. (Chap V, para. 53).

37. Galvanised iron and wrought-iron tubes are essential for rural water supplies from wells and tube-wells, and equally so for house connections in urban supplies. They are not manufactured in India. A TUBE MILL OF CAPACITY OF ABOUT 15,000—20,000 TONS PER ANNUM SHOULD BE SET UP BY GOVERNMENT WITHIN TWO YEARS. (Chap. V, para. 54).

38. Government should also facilitate the import of larger sizes of pumps and motors for water supplies. (Chap V, para. 55).

39. Present consumption of Chlorine for water purification is probably about 300 tons per annum. When our five-year plan is implemented, this

consumption will be about 800 tons per annum. Chlorine is an important chemical, used for general public health work, for bleaching in textiles and paper manufacture and for the manufacture of D. D. T. Production of Chlorine should therefore be stepped up immediately. (Chap. V, para. 56).

40. Alum is also used in water purification. Its annual production is about 6000—7000 tons in India. The demand for this chemical will probably be about 12,000—15,000 tons per annum, when our short-term plan for water supplies is implemented. Increased production of alum should be organised by Government. (Chap. V, para. 56).

41. Many other chemicals may be required for water supplies. Specifications shuld be standardised as far as possible for their supply. (Chap. V, paras. 57—58).

42. The capital cost of water supplies in rural areas should be met entirely by Provincial Governments. The cost and organization for the maintenance of these supplies should also be provided by them through their public health engineering department. If the local board engineer is made answerable to the Chief Public Health Engineer, he may be charged with the duty of maintaining rural water supplies. (Chap. V, para. 71).

43. The capital cost of municipal water supplies should, in principle, be borne at least partly by the municipality. Their share may be fixed as half. The cost of maintenance should be borne entirely by Municipalities. Their share of the capital cost may be advanced as a loan by Government and recovered over a long term of years. (Chap V, para. 72).

44. The Chief Public Health Engineer of every province should have funds placed at his disposal every year for experimentation and research to be conducted in his laboratories or in collaboration with other workers on any water supply problem. (Chap. V, para. 73).

Chapter VI.—Collection and disposal of community wastes

45. The introduction of protected water supplies alone will not be sufficient for achieving healthful living. It is also essential to adopt measures for the hygienic collection and disposal of community wastes. In Chap. VI, these measures have been discussed under the following six headings :

(*a*) Sewerage.

(*b*) Sullage drains and open drains.

(*c*) Sewage disposal.

(*d*) Public cleansing.

(*e*) Disposal of refuse.

(*f*) Collection and disposal of excreta in unsewered areas.

The materials and personnel and organisation required in this connection have also been considered.

46. Only 23 cities out of 48 having population of over 100,000 have sewerage systems. There are 12 oth r towns which are partially sewered. About 3% of the total population is now served by sewerage system, which is the only safe method of disposal of human excreta in congested areas. AS A SHORT-TERM PLAN, TO BE ACHIEVED IN FIVE TO TEN YEARS, THE FOLLOWING MODEST PROGRAMME FOR SEWERAGE IS SUGGESTED IN THE ORDER OF PRIORITY GIVEN BELOW. (Chap. VI, para. 5) :—

(1) URGENT IMPROVEMENTS TO EXISTING INSTALLATIONS AND PREVAILING METHODS OF DISPOSAL IN SEWERED CITIES TO COPE WITH OVERLOAD AND WEAR AND TEAR.

(2) EXTENSION OF SEWERAGE TO NEW HOUSING DEVELOPMENTS AND EXTENSION OF CITY LIMITS IN CITIES WHERE THERE IS ALREADY A SEWERAGE SYSTEM.

(3) LAYING OF SEWERS IN ALL PERMANENT PILGRIM CENTRES.

(4) LAYING OF SEWERS, FOLLOWING THE INTRODUCTION OF SATISFACTORY PROTECTED WATER SUPPLY, IN ALL UNSEWERED CITIES EITHER WITH A POPULATION OF OVER 100,000 OR WITH A HIGH DENSITY OF POPULATION.

(5) LAYING OF SEWERS IN PREDOMINANTLY INDUSTRIAL AREAS.

(6) MORE COMPLETE UTILISATION OF SEWERS IN SEWERED AREAS.

The total outlay required for this programme may be about Rs. 15 crores which can be shared equally-between the municipalities and Provincial Governments exc pt in the case of permanent pilgrim centres. (Chap. VI, para. 6).

47. The Provincial Governments, should, on their own initiative, prepare the sewerage schemes and have them carried out. The share of expenditure chargeable to the municipality may perhaps be financed out of the proceeds of the entertainment tax collected within the municipality. (Chap. VI, para. 7).

48. The cost of laying sewers in all permanent pilgrim centres should be shared equally between the Central Government and the Provincial Government concerned. The share of the Provincial Government may be met out of the funds of religious endowment boards or other interest; that may benefit by improved sanitation. (Chap. VI, para. 9).

49. With regard to the more complete utilisation of sewers in existing sewered towns, Provincial Governments should press municipalities to accelerate progress. If a house-holder does not connect his premises within a year from the date of service of notice, the municipality should carry out the work by a system of subvention through its own agency without waiting further and recover the cost along with rates from him. Provincial Governments should advance loans every year to municipalities for this specific purpose and ensure that at least 90% of the premises are connected within the next 10 years. (Chap. VI, para. 10).

50. Recommendations regarding technical standards, etc., for sewerage systems are given in paras. 3—31 of Chap. VI.

51. We are against the indiscriminate construction of sullage drains. They ought not to be built without ensuring that the houses served by them have sanitary latrines ; otherwise these drains are likely to be used as latrines and urinals (Chap. VI, para. 26). Other technical recommendations regarding sullage drains and open drains are contained in paras. 22—28 of Chapter VI

52. Nothing which is likely to come in contact with sewage and likely to be consumed raw should be grown on a sewage farm. (Chap. VI, para. 33).

53. Sewage farms should be managed under the direction of a competent agricultural expert. (Chap. VI, para. 34).

54. Other (technical) recommendations regarding sewage disposal are given in paras. 29—44 of Chapter VI.

55. Refuse should be collected and disposed of in a manner free from hazard to public health. The hazards arise from fly and rat breeding. " Wealth from waste " is not to be produced at the expense of health. (Chap. VI, para. 45).

56. Government should insist that even the smallest local authority or board should carry out refuse collection and disposal satisfactorily. (Chap. VI, para. 46).

57. Every municipality with a population of over 100,000 should have a well-equipped workshop in which municipal transport vehicles can be repaired and machinery belonging to water works and sewage works can also be repaired. Such workshops should be run on a commercial basis. They should undertake repairs of transport vehicles of smaller municipalities, panchayat boards, etc., if required. (Chap. VI, para. 57).

58. Other (technical) recommendations regarding public cleansing are given in paras. 45—56 of Chap. VI.

59. Composting is no doubt a good method of integrated disposal of refuse and human excreta. If carried out under proper supervision, it will help in food production. (Chap. VI, para. 61).

60. We are of opinion that the value and potentialities of composting of human excreta have been coverrated, while the accompanying dangers to public health have been overlooked. (Chap VI, para. 69).

61. Composting is not advocated for municipalities with a population of over 100,000. Under-ground sewers to transport human excreta are safer in every respect than manual removal of nightsoil from latrnes and should be installed in such cities. If large municipalities are allowed to compost nightsoil, they will develop a complacency about insanitation and put off sewarage for ever. (Chap. VI, para. 62). When cities with a population of over 100,000 are sewered, the nitrogen in the waste can be conserved for agricultural use by sewage farming wherever possible. (Chap. VI, para. 63).

62. In sewered towns, water closets only should be permitted. (Chap. VI, para. 69).

63. As regards smaller municipalities, we would recommend composting of nightsoil on a site at least half a mile away from the municipal limits on the leeward side under good supervision. (Chap VI para. 64).

64. Any proposals to encourage composting in private compounds in municipal areas will be positively dangerous and should be firmly resisted. (Chap. VI, para. 65).

65. In villages and other places where there is no organised refuse or nightsoil collection, composting cannot be carried out efficiently. Only cattle dung will be available. That can be dumped into a manure pit in each compound and covered with straw and ash. Eventually, it can be used as manure every year or half-year. We strongly recommend the construction of such manure pits for cattle dung, straw and leaves, but not the composting of human excreta in rural areas. (Chap. VI, para. 66).

66. We have come across a suggestion that villagers should put up public latrines, defaecate in them and cover the excreta with refuse before leaving. These are said to be designed to produce compost for village use. Knowing the frailities of ordinary human beings and the difficulty of collecting and bringing refuse to a public latrine in a village, we have to state in all humility that the scheme is utterly impracticable. (Chap. VI, para. 67).

67. Other recommendations regarding disposal of refuse are given in paras 58—60 of Chap. VI.

68. In unsewered towns, service latrines are not very satisfactory. We recommend the construction of latrines which require no service and in which the excreta can be disposed of at the site of the latrine in a hygienic manner. The best type is a latrine in which solid and liquid excreta can be washed into a domestic septic tank. (Chap. VI, para. 72).

69. The septic tanks should be provided with means of desludging and should be desludged regularly. (Chap. VI, para. 73).

70. Even if there is not sufficient land for the absorption of effluent from the domestic septic tank, the discharge of effluent into a municipal sullage drains should be permitted if it is already there. The effluent from the tank is not likely to be worse than the raw urine and faces which the drain actually carries (Chap. VI, para. 74.)

71. For villages where 85% of the population lives but hardly 5% of the houses have any latrines, septic tank latrines, well latrines, " Hagari " (Mysore type) latrines, borehole latrines and pit privies are suitable. They require no sweeper service and are reasonably safe and clean within the limitation of low cost and the imperfections of a rural environment. We require millions of them. They cannot, however, be built and presented to each house by health departments of Provincial Governments. Only technical service can be given and inducements offered. A few model latrines of each type should be built in each village for educative purposes. (Chap. VI para. 76).

72. The villagers can be induced to put up latrines in their houses if there is good leadership, backed by an organisation for technical service. Rural panchayats, social service organisations, schools, health centres, etc., are all means of reaching the villager. Rural panchayats specially have potentialities for improving the rural hygiene and getting latrines built in rural areas if their activities are regulated and oriented properly. (Chap. VI, para. 78).

73. IN RURAL AREAS, THE AIM SHOULD BE TO PROMOTE LATRINES IN EACH HOUSE AND NOT PUBLIC LATRINES. (Chap. VI, para. 79). EXPENDITURE ON PUBLIC LATRINES SHOULD BE LIMITED TO THE BAREST REQUIREMENTS IN RURAL SANITATION PROGRAMMES. THE EDUCATION OF THE INDIVIDUAL IS FAR MORE IMPORTANT THAN THE MERE PROVISION OF A PHYSIOLOGICAL NEED. (Chap. VI, para. 81).

74. Public latrines should be built at railway stations, bus stands, parks, places of public entertainment, markets, schools and colleges, hostels, dharamsalas, public offices and places of public worship. The number of seats should be on a standardised scale. (Chap. VI, para. 82).

75. THE PROVISION AND MAINTENANCE OF WATER SUPPLIES IN VILLAGES AND THE INTRODUCTION OF D. D. T. SPRAYING FOR MOSQUITO CONTROL ARE TWO SERVICES WHICH PEOPLE READILY APPRECIATE AND SHOULD BE USED AS LEVERS FOR PUSHING ON LATRINE CONSTRUCTION IN VILLAGES. (Chap. VI, para. 83).

76. BUILDING OF A NEW HOUSE IN OLD OR NEW VILLAGES SHOULD NOT BE ALLOWED UNLESS A LATRINE IS ALSO BUILT. THIS POWER SHOULD BE VESTED IN THE RURAL PANCHAYAT BOARD. GOVERNMENT SHOULD ALSO MAKE AVAILABLE TO THE PEOPLE DESIGNS, MATERIALS AND EQUIPMENT FOR PUTTING UP LATRINES. STANDARD CONCRETE SQUATTING PLATES CAN BE MADE AND SUPPLIED TO VILLAGERS AT COST PRICE. EQUIPMENT FOR PUTTING DOWN BOREHOLE LATRINES SHOULD BE MAINTAINED AT EVERY HEALTH CENTRE AND EVERY SANITARY INSPECTOR'S OFFICE IN THE RURAL AREAS. (Chap. VI, para. 84).

77. As in the case of housing and water supplies, the SHORTAGE OF MATERIALS is a deterrent factor in the implementation of plans for the hygienic collection and disposal of community wastes. It should be overcome by increase of production and better allocation of existing production. (Chap. VI, para 85).

78. There are only three or four large sources and some small sources of supply of stoneware pipes in India and their total production does not exceed 1,200 tons per month. If our modest plans for sewering all cities of over 100,000 are to be implemented, AT LEAST THREE MORE POTTERIES SHOULD BE BUILT AND THE TOTAL PRODUCTION OF STONEWARE PIPES AND DRAINAGE FITTINGS STEPPED UP TO AT LEAST 3,000 TONS A MONTH. THE PRODUCTION OF SANITARY FITTINGS, GALVANISED PIPES, ETC. SHOULD ALSO BE ENSURED. (Chap. VI, para 86).

79. It will be worthwhile for the engineers in charge of large sewage undertakings to arrange for the manufacture of cement pipes in their own factories. (Chap. VI, para 87).

80. Sewage plants need trained personnel for operation. Besides mechanical engineers and electrical engineers for pumping stations, there should be agriculturists for sewage farming and chemists for analysis. Above all, there should be a public health engineer to co-ordinate the work of the people in charge. In the large self-governing corporations, the drainage department should have a public health engineer at the helm. In smaller municipalities, the municipal engineers should be provincialised and placed under the Chief Public Health Engineer. As in the case of water supplies, the Chief Public Health Engineer of a Province should be authorised to certify a work as essential and have it carried out at the expense of the municipality when he finds that the municipality is not co-operative. (Chap. VI, para 88).

81. Refuse collection and disposal can be entrusted to the municipal engineer. The maintenance of transport vehicles and the organisation of labour are the preponderant features of the work and an engineer can do it better than the health officer, provided he has had sufficient training to keep the public health objectives in the forefront. (Chap. VI, para 89).

82. The collection and disposal of excreta and the cleansing of drains are actually carried out by Bhangis or sweepers. They are doing a great humanitarian service and should be given good housing, water supply, latrines and other amenities. Their physical environment should be improved by the municipalities immediately. This should receive a high priority among our short-term plans. (Chap. VI, para 90).

83. Substitution of the human agency by mechanical methods in the collection, removal and disposal of community wastes should be encouraged as far as practicable. (Chap. VI, para 91).

Chapter VII—Food Drink and Milk

84. The danger of transmission of disease through food, drink and milk is great, especially in urban areas where people have to resort to public food and drink establishments. Food, drink and milk should be produced, stored, transported and served under environmental conditions which are free from the dangers of contamination. (Chap. VII, para. 1).

85. Some of the food processing establishments may be outside the limits of a municipality and may escape control by the municipal health authority. The law should be amended so as to ensure better co-ordination between different health authorities in urban and rural areas, so that the wholesale producer can be controlled and not merely the retailer. (Chap. VII, para. 7).

86. Private slaughter houses should not be allowed in any municipal town. Municipal slaughter houses should be built in all towns to type plans approved by the Chief Public Health Engineer of the Province. (Chap. VII, para. 9).

87. The workers in food processing establishments, such as flour mills, bakeries, confectioneries, ice canneries, sweetmeat shops, biscuit factories ice cream plants, aerated water and ice factories, papad, vegetable ghee, vanaspati, papadam manufacturies and manufacture of scented arecanuts and large public kitchens, should be certified medically fit. The control of large food processing establishments should be tightened up by suitable provisions in a Provincial Public Health Act designed to secure closer co-ordination of the municipal and provincial health departments. An inspectorate should be established in the province for regular inspection and quality control in these establishments. Breaches of regulations by these establishments should be liable to deterrent punishment. (Chap. VII, para. 11).

88. Technical recommendations regarding sanitation in concerns which produce articles of food for public consumption, such as dairies, piggeries, goat farms, poultry farms, etc., are given in paras. 12-16 of Chap. VII.

89. The standards for dairies and cattle sheds are detailed in para. 14 of Chap. VII. Municipalities will not be able to enforce these standards merely by prosecution. They will have to build model dairies and then compel the owners of cattle to keep their cattle there on payment of rent. Provincial Governments may also launch schemes like the one that the Bombay Government is carrying out at Are outside Bombay City. Co-operative milk farms may also be permitted outside the municipal limits. (Chap. VII, para. 15).

90. Buildings used for storage of food and foodgrains should be free from damp and should be rendered rat free. The ventilation, temperature and other conditions of the storage establishment should be such as not to encourage spoilage of the articles stored or to endanger the health of the workers there. No wholesale godowns, warehouses and cold storages in the province should be opened without consulting the public health engineer and the health officer concerned. (Chap. VII, para. 17).

91. Recommendations regarding retailing establishments are given in paras. 18-23 of Cahp. VII. Sale of exposed food, cut-fruits, etc., on pavements and in other places should be stopped. To achieve this, public opinion and police action are necessary. Model markets should be built in every urban area. Wholesale markets should have adequate facilities for storage of perishables. In restaurants, eating houses, etc., provision of adequate supply of safe water, provision of a boiler for hot water for sterilisation of utensils, provision of a garbage bin with a lid and provision of washing facilities for customers and staff are essential. The penalty for failing to provide these should be deterrent. Regular spraying of a suitable insecticide should be made a condition for granting a licence for food retailing establishments to operate. (Chap. VII, para. 18-23).

92. Food sanitation in pilgrim centres and alms houses is discussed in paras. 24 and 26 of Chap. VII. The ordinary standard of sanitation relating to restaurants and eating places cannot be applied to these situations. However, it is necessary at pilgrim and poor feeding centres that kitchens should be well lighted and ventilated ; that food should be kept covered and not exposed

till it is served ; that water and food should be served by ladles and spoons untouched by hand ; that washing facilities should be provided for those who at ; and that the leaves and garbage should be cleaned up and disposed of by burial or by feeding them to cows, etc. (Chap. VII, paras. 24 and 26).

CHAPTER VIII.—LIGHT AND AIR

93. Good lighting and good ventilation are conducive to better endeavour, better co-operation and greater and better output in homes, schools, offices factories, etc. (Chap. VIII, para. 2).

94. Windows are used for natural lighting and natural ventilation. Standards for window openings are given in para. 6 of Chap. VIII.

95. Smoke fumes and dust are irritating. They obscure light and pollute the atmosphere. Suggestions for control of domestic smoke are made in para. 8 of Chap. VIII.

96. Atmospheric pollution can be effectively controlled by zoning and gradual shifting of factories from residential zones to industrial zones by legal compulsion and by offering suitable inducements and facilities to factories to shift. In addition, pollution of the atmosphere can be controlled also by offering feasible technical advice to the factories. (Chap. VIII, para. 10).

97. Other recommendations regarding smoke and dust control are given in paras. 11-15 of Chap. VIII.

98. All cinemas and theatres in electrified towns and villages should have artificial ventilation, by means of which the air in the occupied building will be circulated as well as changed. (Chap. VIII, para. 18).

99. Operation theatres should be air-conditioned in provincial and district headquarters hospitals, where the effective temperature is likely to exceed 95°F. (Chap. VIII, para. 19).

100. Third class carriages in railways should be fitted with fans. (Chap. VIII, para. 20).

101. The preceding three recommendations should be carried out within the next ten years. (Chap. VIII, para. 21).

CHAPTER IX.—CONGREGATION

102. Opportunities for transmission of diseases arise and increase wherever people congregate indiscriminately. It is therefore necessary to exclude the dangerous people, to immunise the healthy people and to modify the environment so as to reduce its potentiality for transmitting disease. The exclusion of dangerous people and the immunisation of the healthy are duties for which the medical officer of health is better qualified. The modification of the environment is a duty for which the public health engineer is better qualified. (Chap. IX, para. 1).

103. In India, more attention is paid to the CONTROL of disease in congregations than to other aspects of public health work. It is accorded the highest priority among the various activities of a health department, and we recommend that it should continue to be accorded that priority. (Chap. IX para. 2).

104. The housing of people in places of pilgrimage is generally unsatisfactory. As every room in a pilgrim centre is likely to be occupied by a family, the minimum size of rooms in such places and in all dharamsalas should be 200 sq. ft. The rooms should be at least 10 feet high and have at least 10% of the floor area in the windows. Other detailed recommendations REGARDING WATER SUPPLY, LATRINES, URINALS, REFUSE COLLECTION, ETC., ARE GIVEN IN PARAS. 6-27 of Chap. IX.

105. Places which are predominantly pilgrim centres, sanitaria or spas should be run as Government townships. Central legislation should be passed to enable a provincial government to take over the sanitation, health and other municipal functions of such places in the province. (Chap. IX, para. 28).

106. Schools are places where children from all classes of society congregate and can communicate diseases to one another. The hygiene of the environment in the schools should be of a high standard from the point of view of prevention of disease and, even more so, from that of practical health education. Recommendations regarding schools are given in paras. 30-45 of Chap. IX.

107 Cinema houses and theatres are popluar places of public resort. Their standard in cities is fairly satisfactory, though in moffusil towns they are not so clean. Recommendations regarding these and other places of public resort are given in paras. 49-60 of Chap. IX.

108. The three important means of public transport, which we have considered, are railways, tramways and buses. Overcrowding has become insufferable in all three and the chances of spreading disease by contact have also increased. It is therefore recommended that periodical disinfestation of public transport vehicles should be carried out with D.D.T. or other insecticides. Recommendations regarding public transport are given in paras. 64-72 of Chap. IX.

Chapter X.—Pollution of Streams Lakes and Beaches

109. Rivers, lakes and beaches, which have been revered and sanctified by religious traditions in India, are polluted by the discharge of wastes and excreta by individuals, municipalities and factories without sufficient consideration for the health of other users of the same water or for conservation of acquatic life or for beauty. The Central and Provincial Water and Drainage Boards recommended by the Health Survey and Development Committee will be useful for the control of river and beach pollution. If these boards are not established, due emphasis should be given to the supply of drinking water and to the prevention of the pollution of rivers in the activities of the Central Waterpower, Irrigation and Navigation Commission. (Chap. X, para. 7).

110. Standards for the effluent (sewage or trade waste) with a view to controlling river and beach pollution are discussed in paras. 8-12 of Chap. X.

111. SEWAGE TREATMENT AND INDUSTRIAL WASTE TREATMENT SHOULD BE CARRIED OUT TO THE EXTENT NECESSARY TO ADJUST THE POLLUTIONAL LOAD TO THE CAPACITY OF THE RECEIVING BODY OF WATER FOR SELF-PURIFICATION. THOUGH WE ARE NOT YET RIPE FOR LAYING DOWN STANDARDS BY LEGISLATIVE ENACTMENTS, WE CAN CONTROL POLLUTION BY INVESTIGATION IN EACH CASE. (Chap. X, para. 14).

112. The pollutional status of our rivers should be studied, reaeration constants should be computed and standards should be evolved. Research is necessary. The Water and Drainage Boards, if established, can promote this type of research. Otherwise, the All-India Institute of Hygiene and Public Health, Calcutta, may be encouraged to develop research in a few river basins. (Chap. X, para. 13).

113. Provincial Public Health Acts should contain a provision to the effect that the discharge of sewage or industrial waste into a body of water will be allowed only after the party responsible for the discharge undertakes to carry out the recommendations of the Ministry of Health with regard to the mode of treatment and standard of effluent. (Chap. X, para. 15).

114. The Ministry of Labour should instruct all factory inspectors to refer all questions of treatment and disposal of industrial wastes to the Ministry of Health and get its recommendations implemented. (Chap. X, para. 16).

115. The disposal of sewage on land by farming during dry months after some preliminary treatment may be a suitable means of reducing river pollution. The discharge of the sewage in wet months into a flooded river may be unobjectionable with sufficiently large dilution. (Chap. X, para. 17).

116. Pollution of rivers, lakes and beaches by individuals can be controlled to some extent by constructing and maintaining sanitary latrines and urinals at bathing beaches and ghats. The effluent and excreta from these latrines and urinals should be either connected to public sewers or absorbed in the soil. (Chap. X, para. 18).

117. If problems of river pollution arising between different Provinces or States cannot be solved by negotiation between representatives of their Ministries of Health, the Central Ministry of Health should settle the matter as arbitrator. (Chap. X, para. 19).

Chapter XI.—Industrial Environment.

118. Industries have been growing in India rapidly. They have been associated with the growth of slums and vice in certain places. The subject is vast and we have confined ourselves to some broad observations. In considering the hygiene of the industrial environment, there is a tendency among

many to think only of the worker's environment in the factory and ignore his home environment. This, in our opinion, is incorrect and injurious. Bad housing conditions blight the character and efficiency of the worker and his family and also blight the character and tone of the neighbourhood where the worker lives. Broader perspective and better co-ordination should be brought to bear on the solution of industrial hygiene problems. (Chap. XI, paras 1-2).

119. The number of factory inspectors should be increased so that factories may be inspected more often, preferably twice a year. Small factories require more frequent inspections than large ones. (Chap. X, paras. 5-7).

120. The buildings should be passed as fit for the industry by a competent person before a licence is issued or renewed annually. (Chap. XI, para. 7).

121. Factual data should be collected concerning actual environmental conditions in various industries. Such work is going on now under the auspices of the Indian Research Fund Association ; it should be continued and its scope extended. (Chap. XI, para. 8).

122. The hygiene of the environment of a factory is disccussed in paras. 9-13 of Chap. XI.

123. Training in industrial hygiene should be given to three classes of professional men—doctors, engineers and chemists—with a slight difference in emphasis, so that each can collaborate with the other two in fulfilling his role. (Chap. XI, para. 15).

124. Among other amenities to be provided for the comfort of a worker in a factory, the following should receive special attention : (*a*) supply of drinking water, (*b*) provision of latrines and urinals, (*c*) washing facilities, (*d*) canteens and (*e*) creches. (Chap. XI, para. 16).

125. The drinking water should be disinfected, cooled and supplied untouched by hand. It is not expensive to put up an ice-box with a cooling coil and supply the water through the coil and a fountain, if there is a piped water supply. (Chap. XI, para. 17).

126. The scale of latrine accommodation prescribed in Provincial rules under the Factories Act should be revised to conform to that recommended by us for public latrines. (Chap. XI, para. 19).

127. In public latrines in labourers' colonies, the number of latrines should be provided on the basis of users and not of workers only. (Chap. XI, para. 20).

128. Washing facilities provided for labourers in factories are not inadequate but their maintenance is far from clean. This should be improved (Chap. XI, para. 21).

129. Recommendations regarding industrial canteens are given in Chap. XI, para. 22.

130. Recommendations regarding creches are given in Chap. XI, para. 23.

Chapter XII—Hygiene of the Rural Environment

131. About 85% of the people in India live in villages. Villages are the backbone of our national economy and it is recognised that the rural reconstruction is essential. It has many facets but we have confined ourselves to the reconstruction of the environment from the health point of view. (Chap. XII paras. 1-3).

132. WATER SUPPLY IN VILLAGES IS MOST UNSATISFACTORY. IT IS THE MOST URGENT NEED. NEXT IN IMPORTANCE TO MALARIA, DIARRHOEAS AND DYSENTRIES ARE THE CAUSES OF SICKNESS. WHATEVER MAY BE THE FINANCIAL STRINGENCY, PROVINCES SHOULD CARRRY OUT A SUSTAINED PROGRAMME OF PLANNED RURAL WATER SUPPLIES SPREAD OVER A MUMBER OF YEARS. The work should be carried out by the Public Health Engineering Department or at least under its direction and funds should not be spent without its control. ON AN AVERAGE THE CAPITAL EXPENDITURE MAY BE ABOUT RS. 3/- PER HEAD OF POPULATION SERVED AND THE ANNUAL MAINTENANCE EXPENDITURE CAN BE LIMITED TO ONE TO TWO ANNAS PER HEAD PER ANNUM. (Chap. XII, paras. 4-6).

133. The means of disposal of excreta in villages is very unsatisfactory. There are few latrines and naturally the soil is polluted. The types of latrines most suitable for villages and ways and means of providing them have been discussed in paras. 8-16 of Chap. XII.

134. The houses in villages are generally owned and not rented. These are not generally over-crowded but there are not sufficient windows for lighting and effective cross-ventilation. There is no scope for radical alteration as the villagers are poor. Some improvement can, however, be effected. For example, villagers may be persuaded to construct their cattle sheds away from the house and to dig a manure pit at the corner of the backyard. In addition, the "premises-sanitation" of the house should include spray of D.D.T. at least once in two to six months to control the transmission of mosquito and fly borne diseases. (Chap. XII, paras. 17-26).

135. Village communications are bad, especially in deltaic areas. This is a great handicap to rural reconstruction and health work. Improvement of village communications is essential. (Chap. XII, paras. 27-30).

136. The wholesale replanning of an existing village is not practicable. Some suggestions regarding planning of new villages are given in para. 32 of Chap. XII.

Chapter XIII.—Control of Insects and Other Neclors of Disease

137. Malaria ranks highest among the causes of death and sickness in India. Means directed against the mosquito-transmission of malaria are, in the existing state of knowledge, the only methods which give permanent control. Mosquito control is also required in the case of dengue and filaria. Suggestions for mosquito control are given in paras. 7-17 of Chap. XIII. Main recommendations are :

(1) PUBLIC HEALTH ENGINEERS SHOULD BE GIVEN TRAINING IN MALARIA ENGINEERING. (Para. 8).

(2) PROVINCIAL GOVERNMENTS SHOULD EXTEND RURAL MALARIA CONTROL BY INDOOR RESIDUAL SPRAYING OF D.D.T. IN ALL DISTRICTS WHERE MALARIA IS ENDEMIC. (para. 13).

(3) IN MALARIAL AREAS D.D.T. SPRAY SHOULD BE APPLIED TO EVERY HOUSE PERIODICALLY LIKE WHITE-WASHING. (para. 14).

(4) FACTORIES FOR THE MANUFACTURE OF AT LEAST 3,000 TONS OF D.D.T. PER ANNUM SHOULD BE SET UP IN INDIA BY GOVERNMENT OR WITH GOVERNMENT AID AND CONTROL. (para. 16).

138. PERMANENT MEASURES OF RAT CONTROL ARE NECESSARY FOR CONSERVATION OF FOODGRAINS AND FOR THE CONTROL OF PLAGUE IN THE AREAS WHERE IT IS ENDEMIC. Suggestions for rat control are given in paras. 18-24 of Chap. XIII.

139. The fly is the agent for mechanical transmission of many diseases. Methods of fly control have been discussed in paras. 26-27 of Chap. XIII.

140. D.D.T. sprays will control sandflies, fleas, ticks, bugs, lice, etc. (Chap. XIII, para. 28).

Chapter XIV.—Design and Construction of Medical and Health Centres

141. Demand for hospital accommodation is increasing. The design of medical buildings is therefore a matter of great importance in national planning The main defects of medical and public health buildings as noticed and the broad technical principles that should be applied in constructing them are discussed in Chap. XIV.

Chapter XV.—Other Aspects of Environmental Hygiene

142. Some aspects of environmental hygiene which have not been discussed in previous chapters are dealt with in Chap. XV. These are sanitation in prisons (paras. 2-8), proper disposal of the dead (paras. 9 -12), hygiene of the barber shops and saloons (paras. 13-17), dhobi ghats (paras. 18-20), disinfection stations (paras. 21-23), and plumbing paras. 24-28).

Chapter XVI.—Constructional Materials

143. ACUTE SHORTAGE OF MATERIALS IS NOW THE MOST SERIOUS HANDICAP TO THE IMPLEMENTATION OF ANY SCHEME. The production in the country is insufficient for our requirements even if conditions had remained as they were before the War. We cannot look for relief to imports from other countries due to limited foreign exchange resources. (Chap. XVI, paras. 1-2).

144. THE FIRST STEP THAT GOVERNMENT SHOULD TAKE FOR THE IMPLEMENTATION OF OUR PLANS IS TO REVIEW THE PRODUCTION OF CONSTRUCTIONAL MATERIALS AGAINST OUR REQUIREMENTS AND TO ADJUST INDUSTRIAL POLICY WITH A VIEW TO INCREASING PRODUCTION OF ESSENTIAL MATERIALS FOR

ATTAINING A MEASURE OF NATIONAL SELF-SUFFICIENCY. EXISTING PRODUCTION SHOULD BE CONTROLLED AND ALLOCATED MORE EQUITABLY WITH DUE RECOGNITION OF THE EXTREME URGENCY OF SOME OF OUR PLANS FOR HOUSING, WATER SUPPLY, MALARIA CONTROL, ETC. AT THE SAME TIME, NEW FACTORIES SHOULD BE SET UP TO ATTAIN THE TARGETS OF PRODUCTION BY PRIVATE ENTERPRISE WITH OR WITHOUT STATE AID AND BY STATE ENTERPRISE WITHIN THREE YEARS. The available foreign exchange resources should be conserved for importing the capital equipment required for setting up these factories and for importing those articles which cannot be produced in India. (Chap. XVI, paras. 3-4).

145. Details of requirements are given in respect of bricks (paras. 6-7), coal (paras. 8, 9 and 14), lime (para. 10), cement (paras. 11-14), iron and steel (paras. 15-20), doors and windows (para. 21), timber, tiles and other roofing materials (para. 22), cast-iron pipes (para. 23), galvanised iron and wrought-iron pipes (paras. 24-26), ceramics (para. 27), chlorine (paras. 28-29), alum (para. 30), D.D.T. (para. 31) and other chemicals (para. 32).

CHAPTER XVII.—ORGANISATION AND ADMINISTRATION

146. IT IS ESSENTIAL THAT, BOTH AT THE CENTRE AND IN THE PROVINCES, THERE SHOULD BE A STRONG TECHNICAL ORGANISATION WHICH WILL BE CONSTANTLY AT WORK TO MAKE USE OF EVERY OPPORTUNITY TO IMPROVE ENVIRONMENTAL HYGIENE AND WHOSE SPECIAL RESPONSIBILITY WILL BE TO ENSURE THAT RECOMMENDATIONS MADE IN THIS BEHALF ARE CARRIED OUT. Such an organisation is not found now in the Central Government and in many of the Provinces. (Chap. XVII, para. 1).

147. Plans for environmental hygiene can be implemented only by engineering methods directed towards the public health objective. They are the special field of the public health engineer, who is the right person to take charge of environmental hygiene. The maintenance of health depends on personal health services, which the medical health officer alone is competent to give, and on impersonal health services (or environmental hygiene) which the public health engineer alone is competent to render. Both are essential and both should be organised and co-ordinated in every province and at the Centre. This co-ordination should be arranged by the heads of the two services as equals. (Chap. XVII, paras. 2-4).

148. The public health engineering department should be attached to the Ministry of Health. (Chap. XVII, paras. 5-13).

149. At the Centre, there should be a Consulting Public Health Engineer attached to the Ministry of Health as an Adviser. (Chap. XVII, paras. 14-15).

150. In the provinces, there should be a Chief Public Health Engineer in the Ministry of Health, with headquarters staff for design, investigation, research, etc., and with executive field staff for construction and inspections. (Chap. XVII, para. 16).

151. The status, etc., of the proposed public health engineering staff is discussed in paras. 20-22 of Chap. XVII.

152. THE SERVICES OF MUNICIPAL ENGINEERS AND OPERATORS OF WATER AND SEWAGE WORKS SHOULD BE PROVINCIALISED. (Chap. XVII, paras. 23-26).

153. A COMPREHENSIVE PUBLIC HEALTH ACT SHOULD BE PASSED IN EVERY PROVINCE. (Chap. XVII, para. 28).

154. Necessary legislation should also be enacted to ensure that local bodies perform elementary functions of environmental hygiene to standards prescribed by the Ministry of Health. (Chap. XVII, para. 29).

155. A revenue of Rs. 13/- per capita per annum will be necessary to maintain efficient municipal services. The actual revenues of many municipalities are only Rs. 3/- to Rs. 5/- per capita. The Local Finance Enquiry Committee, set up by the Central Ministry of Health, is investigating ways and means of improving these revenues. The recommendations of that Committee should receive due consideration. UNLESS THE FINANCES OF LOCAL BODIES ARE INCREASED, THEY CANNOT IMPROVE ENVIRONMENTAL HYGIENE. (Chap. XVII, para. 30).

CHAPTER XVIII.—TRAINING OF PERSONNEL

156. The public health engineering service that has been proposed in Chapter XVII can be an effective instrument for rendering service and can produce results if qualified personnel is appointed at least to the senior posts. HENCE, THE ORGANISATION OF TRAINING IS OF THE UTMOST IMPORTANCE. HOWEVER, THE UTILISATION OF TRAINED PERSONNEL SHOULD NOT LAG BEHIND TRAINING. If it does, there will be wastage of talent, frustration and discredit to the courses of training. (Chap. XVIII, para. 1).

157. The training of personnel for responsible positions in public health engineering should be both academic and practical. What is ingested in the lecture room is digested and assimilated only in the field. The value of experience should not be under-rated. If it is combined with academic methods of approach to problems, it is possible to develop leadership in the profession. At least in the earlier stages more opportunities should be given to people with mature experience to undergo training than to immature persons who have not made up their minds about their future career. A DEFINITE PERCENTAGE OF FOREIGN SCHOLARSHIPS, ETC., SHOULD BE EARMARKED FOR PUBLIC HEALTH ENGINEERING. (Chap. XVIII, para. 2)

158. The Central Government should assume responsibility for training personnel required for improving environmental hygiene. Different categories of personnel required for improving environmental hygiene are :—

(a) Public Health Engineers.

(b) Public Health Engineering Subordinates.

(c) Town Planners.

(d) Plant Operators.

(e) Medical Health Officers.

(*f*) Sanitary Inspectors.

(*g*) Specialists in Public Health Chemistry, Biology, etc.

(*h*) Industrial Hygienists.

THE TRAINING OF HIGH-GRADE PERSONNEL SHOULD BE THE RESPONSIBILITY OF THE CENTRAL GOVERNMENT FOR AT LEAST TEN YEARS TO ENSURE UNIFORMITY OF STANDARDS. (Chap. XVIII, para. 6).

159. Recommendations regarding the training required for public health engineers are given in paras. 7-17 of Chap. XVIII. Public Health Engineers should be basically engineers and not civil engineers only. (Chap. XVIII, para. 7).

160. The course of training organised at the All-India Institute of Hygiene and Public Health, Calcutta, for the degree of Master of Engineering (Public Health) and the syllabus prescribed therefor are suitable for training men for senior posts. (Chap. XVIII, para. 10).

161. When the demand for public health engineers increases as a result of the implementation of our recommendations, other centres for training Public Health Engineers should be opened in addition to the one at the All-India Institute of Hygiene and Public Health. If there are three or four engineering colleges in a Province, all of them need not have such a specialised course. We would warn against mass production under poor training facilities. (Chap. XVIII, para. 13).

162. The specialised training for public health engineering should be given as a post-graduate course and not an undergraduate course (Chap. XVIII, paras. 14-17).

Chapter XIX—Finance

163. Financial implications of our recommendations are summarised and set forth in Chap. XIX. The present financial stringency need not act as a deterrent to their implementation. The beginnings will not cost much and, during the time required for organising personnel and materials, the financial position may improve.

(B. C. DAS GUPTA),
Chairman.

(P. C. BOSE),
(R. S. MEHTA),
(N. V. MODAK),
(K. SUBRAHMANYAN)
Members.

(G. C. MITROO),
Secretary.

Dated New Delhi, the 18th October, 1949.

... Sanitary Inspectors ...

... in Public Health Chemistry, Biology ...

... Industrial Hygiene ...

THE TRAINING OF PUBLIC HEALTH PERSONNEL SHOULD BE THE RESPONSIBILITY OF THE CENTRAL GOVERNMENT ... MINISTRY OF HEALTH. (Chap. XVIII, para. ...)

... Public Health Engineers ... (Chap. XVIII, para. ...)

160. The course of training ... at the All-India Institute of Hygiene and Public Health, Calcutta ... Master of Engineering (Public Health) ... (Chap. XVIII, para. 102).

161. When the demand for public health engineers increases as a result of the implementation of our recommendations ... facilities for training of Public Health Engineers should be expanded ... besides the one at the All-India Institute of Hygiene and Public Health ... four engineering colleges ... specialised course ... (Chap. XVIII, para. ...).

162. The specialised training for public health engineers should be given as a post-graduate course and not as an undergraduate course. (Chap. XVIII, para. 107).

CHAPTER XIX—FINANCE

163. Financial implications of our recommendations are summarised ... in Chap. XIX. ... The ... will ... during the time required for ... position may improve.

(Sd.) [illegible]
Chairman.

(P. C. BOSE),
(B. S. SHUKLA), Members.
(... MOHAN),
(K. SUBRAHMANYAM).

([illegible]),
Secretary.

New Delhi, the [illegible] 1960.

APPENDIX I.

(*Vide* Chapter I, para. 6.).

QUESTIONNAIRE ISSUED BY THE ENVIRONMENT HYGIENE COMMITTEE CONSTITUTED IN JUNE 1948 BY THE MINISTRY OF HEALTH, GOVERNMENT OF INDIA.

SECTION A.

HOUSING—TOWN AND VILLAGE PLANNING.

1. *Survey.*—In any programme of housing improvement, do you consider it essential that a survey of the existing habitations should be undertaken first with a view to finding out how far they satisfy the minimum requirements for health and sanitation and how far they could be improved to satisfy the said minimum standards ? If you agree, what methods and agencies would you suggest for carrying out such surveys ?

[*Note* :—Results to be recorded in a form of quantitative penalty, scores and of specific basic deficiencies.)

2. *Check-up.*—Do you consider that, besides the initial survey, a periodical check-up of existing habitations is necessary ? Should this check-up be more or less continuous or only at stated intervals ?

What agency would you consider suitable to carry out the check-ups ?

3. *Powers, Agency, etc.*—What powers, agency and procedure do you consider necessary to have improvements effected as disclosed in the surveys and check-ups ? Are the present legislation and agency adequate for the purpose ?

4. *Financial.*—How far does financial difficulty of the owners operate against improvements ? Have you any useful suggestions to relieve financial difficulties so as to get improvements effected to existing habitations ?

Are you in favour of money and/or materials being advanced to effect those improvements treating such advances as first charge on the property ?

What period would you specify for the repayment of the advance made ?

5. *Community facilities.*—What minimum ' community facilities ' should be provided for—

(*a*) new house areas,

(*b*) built-up areas, and

(*c*) rural areas ?

In the case of urban areas, how would you delimit areas for which these facilities should be provided ?

Note :—Community facilities are needs which are satisfied outside home. They exclude work time activities. They are, however, wider than the leisure time interests for they embrace health, educational and shopping activities. It is difficult to define the term ' communal facilities ' because the needs will vary as between different communities.

COMMONWEALTH HOUSING COMMISSION—(Second and Interim Report.)

6. *Cost reduction.*—Keeping in view the dearth of materials such as iron, teak and cement, what materials of construction would you recommend to keep down the cost of building, with specified *minimum* standards for health and sanitation ?

7. Have you any suggestions as to how to construct cheap houses satisfying the minimum requirements for health and sanitation ?

8. *National Building Code.*—Having regard to the varieties of design, construction and provision of amenities in respect of dwellings constructed by several administrations, local and governmental institutions, industries and others alike, do you not consider it necessary to lay down a National Building Code to ensure health and sanitation somewhat on the lines on which other countries have done, notably Canada, U.S.A., and Australia ?

If you agree that a National Building Code is necessary for the purpose, what minimum standards would you prescribe ?

(In giving your answer to this question, you may take into account the basic principles of healthful living already laid down by the Special Committee on the Hygiene of Housing, organised by the American Public Health Association—*vide* Appendix to Section A.)

9. *Pre-fabrication.*—Do you consider that provision of pre-fabricated houses on a mass scale would accelerate the progress of housing ? What is your opinion on the suitability of the pre-fabricated houses to our climatic and living conditions ?

10. *Master plan.*—Do you consider that the preparation of a ' Master plan ' for any local area should be undertaken *before* improvements are carried out ? If you do, what considerations should govern the preparation of a ' Master Plan ' ?

11. *Housing the poor.*—What is the present position regarding town-planning schemes under execution ?

Is there a provision in the scheme for housing the poor population who depend on the upper class for whom houses are provided in an area ?

Do you consider that every scheme should provide for such housing in the midst of every upper-class locality ?

(*Note* :—The reference is to housing of domestic servants, petty traders and the like.)

12. What comments have you to make on the existing conditions of housing of industrial labour in your province or in your area ?

Do you consider that in places where industries have been responsible for the insanitary habitation of their workers, it would be reasonable and equitable to call upon the industrialists concerned to improve conditions at their cost to comply with the minimum standards within a specified time ? If the industrialists are willing to come forward to effect the improvements, what facilities should be afforded to them ?

13. For housing workers in cottage industries in rural areas, do you recommend that standard designs to suit each industry should be prepared consistent with the minimum requirements of health and sanitation (say, for instance, weavers, village blacksmiths and others) ?

14. *Economic rent.*—What do you consider the economic rent for different classes of the labouring and poor population in urban and rural areas ?

What will be the cost of a house for such a family which will satisfy the minimum standards ?

What suggestions can you make for the provision of such houses which will be within the rent-paying capacity of the poor ?

If subsidising is necessary, what do you consider the best agency to undertake such projects ?

15. Do you consider whether any control of rent by Government or local bodies on any standardised basis will help in enabling poor and middle class people to find accommodation ? If so, give practical suggestions.

16. If housing accommodation is provided on the outskirts of the existing limits of a locality (which may be some distance away from the business or work), what suggestions have you to make to provide for transport facilities ? What is your experience ? What is your experience of the success of satellite towns in their practical working ?

17. *Town-Planning in rural areas.*—What principle should govern Town-Planning in rural areas ?

(*Note* :—Indian village life is peculiar in many ways. It has long established traditions to live as a community. In answering the above question, please bring out what in your opinion would be an ideal village life for which provision should be made.)

18. *Slums.*—(*a*) What are the reasons in your opinion which contribute to the continued existence and increase in the number of slums on private property ?

(*b*) What are the attempts made in your area to eradicate or improve such slums ?

(*c*) What are the difficulties and obstacles encountered ?

(*d*) What remedy would you suggest for the eradication or improvement of slums on private property ?

(*e*) Do you consider a modification of legal powers necessary ? Do you think an independent agency can enforce the legal provision more effectively ?

19. *Priority in housing.*—Which class of persons do you consider need housing provision first—the poor, the middle class or the rich ? If the State is to provide houses, should it not be for the poorer classes first ?

Do you not consider that housing necessary for the middle and upper classes can be left to private enterprise ?

20. Do you not consider that the State as an deal and largest employer should set an example by providing houses for all its employees ?

21. *Uniform standards.*—Do you consider that, having laid down a National Building Code to satisfy the minimum requirements of health and sanitation, and differentiation should be made in the standards for housing industrial and other labourers and the masses in general ?

22. *Laws and by-laws.*—(*a*) Do you consider that the laws and by-laws governing the construction of residential and other buildings are satisfactory ? If not, what amendments will you suggest ?

(*b*) Are you satisfied that the *existing* laws and by-laws are being enforced properly ?

(*c*) Please indicate any difficulty or obstacles encountered in their enforcement.

(*d*) What remedy will you suggest to get over the difficulties or obstacles ?

(*Note* :—It would be helpful if the positi)n is discussed separately in respect of rural and urban areas.)

23. *Improvement Trusts.*—(*a*) Do you consider that slum clearance, removal of congestion and similar town improvements should be entrusted to the local authority or to a separately constituted city Improvement Trust ?

(*b*) What areas would you suggest for the constitution of an Improvement Trust, If you prefer an Improvement Trust ?

(*c*) What suggestions can you make to delimit the functions of the local authority and the Improvement Trust and to avoid friction between the two ?

24. *Method of financing.*—(*a*) In your area have the town planning schemes been financially a success ? If not why not and what suggestions have you to offer to make them a success financially ?

(*b*) To provide funds for the repayment of loans required for urban housing schemes, removal of congestion and slum clearance the following methods are suggested :

1. A surcharge or an increased taxation on owners of more than one house in a local area
2. Increasing the rate of property tax with a higher rate on houses of a higher rental value.
3. A special levy on employers to provide housing for their employees.
4. A betterment contribution from existing property owners who benefit by slum clear ance and other improvements in the neighbourhood.
5. Issue of local long-dated bonds at low interest.

Please indicate, with reasons, your preference, if any, for the methods of financing. Can you suggest any other method ?

25. *Directorate of Town-Planning.*—Is there a separate Director of Town Planning and a Town Planning Department functioning in your Province or State ? Or, is this work entrusted to the Sanitary Engineer or Public Health Engineering Department ? What part is played by the Public Health (Medical) Department in this respect ?

Which do you consider best among the following ?

1. A separate Directorate of Housing, a separate Directorate or Town-Planning, and a separate Public Health Engineering Department.
2. A Directorate of Housing and Town Planning, and a separate Public Health Engineering Department.
3. A single co-ordinated Public Health Engineering Department ?

26. *Co-ordination of work.*—Do you consider that in every Province or State the Ministry of Health should be entrusted with Housing and Town Planning, or do you feel that there should be a separate Ministry for Housing and Town Planning in each Province or State ? If you are of the latter view, indicate how you will delimit the functions between the Ministry of Health and the Ministry of Town Planning.

27. Do you not consider that better co-ordination and expeditious despatch of business would be facilitated if the Ministry of Health is charged with the responsibility of all works calculated to improve the health of the people, such as housing, town-planning, water-supply sanitation, recreation, control of fairs and festivals and the like ?

28. *Staff.*—What staff do you consider necessary for Housing and Town Planning in the Directorate General of Health Services of the Government of India ?

Would you prefer a separate Expert/Adviser on this subject, apart from an Expert/Adviser on all matters relating to Public Health Engineering ?

29. *Deputation to foreign countries.*—Do you consider that, for designing of towns and village plans in our country, we should send selected individuals to Europe and America for training in the subject ?

Do you consider that foreign Town Planning Experts should be imported on short-term contracts to train and to open training centres ? Has any foreign expert been requisitioned to tender advice on town planning in your area and, if so, what action has been taken on his report ?

30. *Training centres.*—Do you consider that training centres for town-planners should be started under the aegis of Universities or whether such training centres should be outside the scope of University education ?

31. *Legislation.*—(*a*) In the matter of Town-Planning legislation, would you lay down any general principles which should be uniformly adopted in the country, having regard to the experience gained in places where Town-Planning legislation has already been undertaken ?

(*b*) In view of the practical difficulties involved in working out development schemes within a local area on account of the difficulties of acquisition of land, do you consider that some legislative measures should compel the owners of properties who are out to sell them to give the first option of purchase to the local authority concerned ?

APPENDIX TO SECTION A (SEE QUESTION 8.)

Basic Principles of Healthful Housing.

A. FUNDAMENTAL PHYSIOLOGICAL NEEDS.

B. FUNDAMENTAL PSYCHOLOGICAL NEEDS.

C. PROTECTION AGAINST CONTAGION.

D. PROTECTION AGAINST ACCIDENTS.

Under each of the above four heads, the following principles have been recommended :—

A. FUNDAMENTAL PHYSIOLOGICAL NEEDS.

1. Maintenance of a thermal environment which will avoid undue heat loss from the human body.
2. Maintenance of a thermal environment which will permit adequate heat loss from the human body.
3. Provision of an atmosphere of reasonable chemical purity.
4. Provision of adequate daylight illumination and avoidance of undue daylight glare.
5. Provision for admission of direct sunlight.
6. Provision of adequate artificial illumination and avoidance of glare.
7. Protection against excessive noise.
8. Provision of adequate space for exercise and for the play of children.

B. FUNDAMENTAL PSYCHOLOGICAL NEEDS.

9. Provision of adequate privacy for the individual.
10. Provision of opportunities for normal family life.
11. Provision of opportunities for normal community life.
12. Provision of facilities which make possible the performance of the tasks of the household without undue physical and mental fatigue.
13. Provision of facilities for maintenance of cleanliness of the dwelling and of the person.
14. Provision of possibilities for aesthetic satisfaction in the home and its surroundings.
15. Concordance with prevailing social standards of the local community.

C. PROTECTION AGAINST CONTAGION.

16. Provision of a water-supply of safe sanitary quality available to the dwelling.
17. Protection of the water-supply system against polution within the dwelling.
18. Provision of toilet facilities of such a character as to minimise the danger of transmitting disease.
19. Protection against sewage contamination of the interior surfaces of the dwelling.
20. Avoidance of insanitary conditions in the vicinity of the dwelling.
21. Exclusion from the dwelling of vermin which may play a part in the transmission of disease.
22. Provision of facilities for keeping milk and food undecomposed.
23. Provision of sufficient space in sleeping rooms to minimize the danger of contact infection.

D. PROTECTION AGAINST ACCIDENTS.

24. Erection of the dwelling with such materials and methods of construction as to minimize danger of accidents due to collapse of any part of the structure.
25. Control of conditions likely to cause fires or to promote their spread.
26. Provision of adequate facilities for escape in case of fire.
27. Protection against danger of electrical shocks and burns.
28. Protection against gas poisonings.
29. Protection against falls and other mechanical injuries in the home.
30. Protection of the neighbourhood against the hazards of automobile traffic.

(*Note* :—Codes and Specification Section of the National Research Council, Ottawa, published in June 1940 a National Building Code specifying the requirements bearing on Health and Sanitation.)

SECTION B.

Medical Buildings.

How do you think that proper sanitation can be ensured in the design of such buildings as general hospitals, special hospitals, dispensaries, sanatoria, maternity homes, nursing homes, health centres and the like before actual execution begins ?

SECTION C.

Water Supply—Urban and Rural.

1. *Reduction in cost.*—Have you any special suggestions to make to reduce the capital and maintenance cost of water-supply schemes ?

2. *Life of schemes.*—A considerable time lag between the date of investigation, the date of design, the date of final sanction and the dates of commencement and completion of water-supply schemes results in the scheme proving inadequate to meet the demands of the people, even when it is opened for service. At any rate, this is the experience in many towns in Madras Presidency. Does your observation support this experience ? If so, what suggestions have you to obviate the time lag and to ensure that the scheme, when completed, meets the full needs of the area for at least THIRTY years thereafter ?

3. *State responsibility.*—Do you consider that the entire responsibility for providing safe drinking water and drainage should be the responsibility of the State.

4. *Time limit.*—Do you consider that a time limit should be fixed, say, TEN YEARS, within which two basic necessities of life, water-supply and drainage, should be fully provided to the people, urban and rural ?

5. *Procedure in financing.*—As regards the financing of water-supply and drainage schemes, what is the procedure now in vogue ? Do you find it satisfactory ? Have you any suggestions to make on the subject ? For example, do you favour the creation of a Provincial drainage and water-supply fund and make it obligatory on the Provincial Government or the State to add amounts to it annually from Provincial revenues ?

6. *Water-supply and Politics.*—Do you consider that, in the matter of the administration of water-supply, local politics play any prejudicial part ?

7. Do you favour the State owning the responsibility for the maintenance of the schemes also ?

8. *Meters versus ' Tap-rate '.*—Do you consider that every domestic service should be metered ? Do you favour the imposition of a progressive ' tap-rate ' for domestic water-supplies instead of meters ?

9. *Waste control.*—Do you favour the introduction of regional waste water control system in preference to metering individual services ?

10. *Joint water supply schemes.*—To supply water to places where the natural environments do not afford facilities for developing a local supply economically, do you think a joint water supply scheme to serve areas *en route* may be thought of on certain financial arrangements to be decided upon beforehand ?

11. *Materials bulk purchase.*—Do you think that the purchase of materials for water-supply and drainage systems on a bulk basis would tend to reduce cost ?

12. *Private Engineering Firms.*—In view of the fact that inordinate delay results in Government departments in investigating, designing and executing work, private engineering firms should be utilised to supplement the efforts of State departments. Do you agree ? What is the rate of centage charged by the Provincial Government for the investigation, design and execution of schemes of water supply and drainage ?

Note :—This suggestion is made to accelerate progress.

13. *Manufacture of materials.*—Do you experience any difficulty in obtaining matérials for water supply schemes and in allocating available materials among different works ? What are your suggestions for improving them ? Have you any suggestions for accelerating the progress of rural water supply schemes ?

14. *Priority of schemes.*—Do you recommend that any priority should be fixed for the provision of water-supply and drainage schemes having regard to the local conditions ?

15. *Accounts.*—What procedure would you lay down to ensure funds realized from the operation of water works being made available for improving the specific service ?

SECTION D.

Public Cleansing and Rural Sanitation.

1. *Abolition of ' scavenging ' as such.*—Do you consider that ' scavenging ' as such, which is at present confined to certain castes, should be altogether abolished ?

2. *Public cleansing.*—Do you not consider that ' public cleansing ', as it is called in advance countries, should form part of the duties of the Public Health Engineer?

3. *Basis of organisation.*—Having regard to the great importance of public cleansing, do you consider that this service, in particular, should be organised on semi-military lines ?

Note.—The frequent breakdown of the service for many reasons up-sets and even threaten the safety of the life of the community.

4. If you recommend the organization of public cleansing on a *essential service* basis, what conditions of service would you lay down ?

5. *Adequacy of cleansing service.*—Do you consider that the methods now in vogue in urban and rural areas for the storage, collection, conveyance and disposal of refuse satisfactory ? If not, in what respects, do you consider the methods unsatisfactory and what do you suggest for improving this in urban and rural areas respectively?

6. *Dust bins.*—Do you consider that ' dust bins ' provided in certain towns in the streets are satisfactory ? Can you suggest what you consider an ideal model ?

7. *Bins for every dwelling.*—Do you consider that bins for household refuse should be provided in every house ? If you agree, what principles should govern their design and location in the premises ?

8. Do you recommend hire-purchase system in the provision of dust bins in dwellings ?

9. *Standardization.*—Would you recommend the standardisation of tools and plants to be employed in public cleansing ? If you do, can you kindly indicate how the tools and plants could be standardized and where they should be manufactured ?

10. *' Controlled tipping ' versus indiscriminate dumping.*—Do you consider that the indiscriminate dumping of refuse to fill up the hollows (a practice followed in certain cities) is satisfactory ?

11. Do you recommend 'controlled tipping' as a better method of disposal and reclama on of land ?

12. *Rural latrines.*—Having regard to the fact that the services of scavengers are not as a rule available in remote rural areas, what types of latrines would you recommend for adoption in rural areas ?

13. If borehole latrines or septic-tank latrines are recommended, what conditions should be satisfied to ensure their efficient working ?

14. Do you recommend trench latrines for rural areas ?

15. *Compost.*—What is your opinion on the manufacture of compost ? Have you found a ready demand for compost from agriculturists ?

16. *Trade and domestic refuse.*—Do you consider that a distinction should be made between trade refuse and domestic refuse ? If you agree, what kinds of refuse should be brought under each category ? Do you favour special charges being levied for the collection of trade refuse ?

Note.—It is not unusual that wastes from commercial institutions are dumped in the streets in large quantities necessitating special arrangements being made for their collection and conveyance. It is also a common sight to see that the owners of big gardens shoot a large quantity of garden refuse in the streets. But they do not pay anything extra for their refuse being conveyed. If a distinction is made and a special fee is imposed, it may result in increasing the revenue to some extent.

17. *Legal provisions.*—What legal provisions would you suggest to ensure public cleansing being carried out efficiently ?

SECTION E.

Drainage, Sewerage and Sewage Disposal—Urban and Rural.

1. *Basic principles of design.*—Do you consider that the basic principles of design of a sewerage scheme should be determined for general adoption ? If you do, what suggestions have you to make in regard to the following points in particular ?

(*i*) The carrying capacity of sewers.

(*ii*) Self-cleansing velocities afloat.

Note.—Varying hydraulic tables giving varying results are available ; which formula would ou recommend for uniform general adoption ?

(*iii*) Location of man holes.

(*iv*) Location of ventilating shafts.

(*v*) Point at which an overflow should operate.

(*vi*) Whether the overflow should be subject to any treatment before being discharged into water-courses.

(*vii*) Materials of construction.

(*viii*) Special precautions to avoid tap-roots of trees penetrating the sewers thraugh the joints.

2. *Treatment of sewage.*—In regard to the sewage disposal, do you recommend for general adoption the treatment of sewage on land, where adequate area of suitable land is available ? If you recommend this method of disposal, do you consider that the sewage should be subject to any preliminary treatment or would you be satisfied if the sewage is subject to screening only ?

3. In what circumstances, would you recommend the treatment of sewage by proprietary processes ?

4. Would you prefer open drainage as opposed to sewerage being adopted in towns ?

5. *Rural drainage.*—In regard to the drainage of rural areas, would you insist upon the sewerage being introduced or would you be satisfied with open drains carrying sullage and storm-water ?

6. *Decentralized disposal of sewage.*—With a view to avoiding drains being constructed over long distances, would you recommend decentralized disposal of sewage in rural areas, provided of course the natural contour of the country would admit of this being done ?

7. *Responsibility for investigation, design and execution.*—In the execution of water-supply and drainage schemes, do you approve of the authorities responsible for investigation, design and after-maintenance being divorced from execution ?

Note.—This question is put as, in some provinces, one department is responsible for investigation, design and after-maintenance, while another is in charge of the execution of the schemes.

SECTION F.

Food Sanitation—Food Establishments—Food Preservation.

1. *Safety of food, hotels, etc.*—What are the steps taken at present to ensure the safety of food supply in public hotels, eating houses, restaurants, canteens and other such places ? Do you find any defects in them ? If so, what are they ? What measures would you recommend to ensure safety of the food sold to the people ?

2. What laws and byelaws now govern the licensing of these institutions ? Do you find them satisfactory ? If not, in what respects are they defective and what legal steps should be taken to rectify the defects ?

3. *Sanitation of utensils.*—What steps are now being taken to ensure the sanitation of cooking and other utensils used in such institutions ? What methods would you recommend to ensure their sanitation ?

4. *Design and features.*—Are you satisfied with the structural designs of hotels, eating houses, restaurants and similar establishments.

5. Do you not think that a standard design should be prepared in respect of each of them and adopted in practice ?

6. Do you consider it desirable that local authorities should build some of them at their cost and run them under their control or rent out the buildings under certain conditions ?

7. Do you think that such model institutions would help to improve local finance, apart from their having an educative value ?

8. Would you advise that the adoption or adaptation of such standard designs should be made a condition precedent to granting licences ?

9. *Sanitary code.*—Do you consider that a sanitary code governing clean handling and ervice of food is necessary ? If you agree, do you think that the following points are essential :

(*a*) Design of eating or drinking places ;

(*b*) Their equipment ;

(*c*) Proper protection of food in preparation, storage and service ;

(*d*) Maintenance of clean conditions ;

(*e*) Methods of washing and disinfecting eating and drinking utensils ;

and (*f*) Health of food handlers ?

10. *Food handlers.*—Do you not consider that education of food handlers along the line of good sanitation is essential ?

11. At present what steps are being taken to make sure that food handlers are not carriers of typhoid and other such diseases ? Do you not consider that steps should be taken to ensure, that food handlers are not carriers of typhoid, etc. ?

12. Do you consider that health certification of food handlers is necessary ? If so, at what, intervals should they subject themselves to medical examination ?

13. Which agency would you recommend for examining food handlers ?

14. (*a*) *Aerated water, factories, etc.*—What are the minimum sanitary requirements which you would suggest in the case of aerated water factories and ice factories ?

(*b*) Would you suggest any special design for these industries ? If so, what are the basic principles of design ?

15. *Bakery, etc.*—What minimum standards of sanitation would you prescribe in the case of a bakery, confectionary and sweetmeat shop ?

Please give the basic principles of any standard design which you may suggest.

16. Do you consider control of the persons employed in these institutions necessary ? If so, please suggest the legal powers, agency and procedure necessary.

17. *Food wraps.*—As regards the manufacture of food wraps and containers, do you consider it necessary to prescribe sanitary and bacteriological standards for plants engaged in the fabrication and handling of food wraps and containers ?

18. *Milk.*—What are the essentials which you would recommend to ensure milk sanitation having due regard to the traditional methods in vogue in the country ?

19. What inspection and sanitary control would you recommend ? Do you consider the existing law, if any, governing the sale of milk satisfactory ? If not, what legislation would you recommend ?

20. Do you recommend any special protection to be taken in regard to sanitary conveniences to be provided in connection with dairies ? If so, what are they ?

21. What principles should govern the design of cow-sheds and their sanitation ?

22. In regard to the utensils used in connection with milk, what precautions would you recommend to ensure their safety ?

23. If a pasteurisation plant is installed, what design would you recommend in regard to the ocation of its several component parts ?

24. (*a*) In urban areas, would you recommend keeping of cattle or would you recommend their being kept outside the limits ?

(*b*) Do you consider that keeping of cattle in urban dwellings or in their immediate neighbourhood results in insanitation ?

(*c*) In the alternative, would you segregate cattle sheds at convenient spots within the urban area ?

(*d*) Having regard to the conditions obtaining in our rural areas, what suggestions have you to make to ensure cattle being kept in, or in the immediate vicinity of, dwellings ?

(*e*) Can you lay down what principles should govern the design of cattle sheds ?

25. *Slaughter-houses.*—What are the statutes and byelaws now enforced governing the location, construction and maintenance of slaughter-houses ? Do you consider them satisfactory ? Would you suggest any special legislation on the subject and, if so, what are your suggestions ?

26. Are you satisfied with the design, construction and maintenance of slaughter-houses ? f not, in what respects are they defective and what measures would you suggest to improve hem ? In your opinion, what principles should govern their design, construction and main-nance ?

27. In regard to the flooring of the slaughter-house, have you any suggestions to make ?

28. Pending despatch of meat to the markets, what arrangements would you make for to mporary storage of meat ?

29. What methods of conveyance of meat to the markets would you recommend ?

30. What sanitary conveniences would you recommend in connection with slaughter-houses h regard to their location, design, construction and maintenance ?

31. As regards the disposal of waste from slaughterhouses, what methods would you suggest ensure sanitary maintenance of the slaughter-house ?

32. As regards the men employed in slaughter-houses, what precautions would you recommend to ensure safety of meat handled by them ?

33. Experience elsewhere, has shown that meat inspection service should include the following :—

(*a*) Require that all dressed meat exposed for sale should be inspected ;

(*b*) See that animals are inspected before and after slaughter ;

(*c*) Require that slaughter-houses should be kept in a sanitary condition and inspectors should be present during slaughter ;

(*d*) Require branding of condemned carcasses in such a manner as to prevent their sale in the community ;

(*e*) Require inspection of meat markets in regard to their sanitation ;

(*f*) Places of inspection and slaughtering under the immediate supervision of a qualified veterinarian selected by merit system ;

(*g*) Require the inspectorate to make periodic reports available to the public.

Do you consider these essential or would you suggest any amplification or modification ?

34. *Street hawking.*—In and about educational institutions, places of recreation and the like, street vendors sell eatables. They are exposed to gross infection by flies, dust and handling. What suggestions have you to make sure that the eatables sold in these places are safe ?

35. *School or college hostels.*—Do you consider that hostels attached to educational or other institutions should be subject to the same control as eating houses, hotels, restaurants, etc. ?

36. *Railway restaurants and dining cars.*—To serve the requirements of the Railway travelling public, do you consider that restaurants and eating places maintained on the Railway platforms should be subject to control on the lines on which other such places should be controlled ?

37. Do you consider that dining cars in the Railways should be subject to control ? If so, in what respects ?

38. Do you consider that street-hawkers of eatables should be licensed ? What precautions would you suggest to protect the food from contamination ?

39. *Hospital kitchens.*—In regard to sanitation of kitchens in hospitals, what steps should be taken to maintain a high state of sanitary efficiency ?

40. Have you any suggestions to make in respect of the location of kitchens in the hospital premises, storage of food and distribution to patients ?

41. Do you recognize the importance of clean dishes and utensils in a hospital ? Are you satisfied with the existing conditions ? If not, in what respects improvement is called for ?

42. *Temple kitchens.*—Do you consider it necessary that the preparation of PRASADHAMS in temples and their distribution or sale should be controlled ? If so, please give an outline of the principles under which they should be controlled.

43. *Factory and office canteens.*—What are the minimum sanitary requirements in canteens attached to factories, offices and such places of employment ?

44. *Community feeding.*—What measures of control would you suggest in the case of free feeding given in choultries and other places ? Please give outlines of the legal powers, agency and procedure for the control you suggest.

45. *Storage of food grains.*—What are the essential precautions which should be taken fo the storage in bulk of food grains, such as rice, wheat, grams and the like ? What legal provision and agency would you suggest for the enforcement of these precautions ? Regarding the storag of food grains for sale in retail and in bulk in urban and rural areas, what requirements should b specified and what designs should be recommended for general adoption by shop-keepers an villagers alike ?

46. *Perishable foodstuffs.*—In respect of refrigeration of perishable foodstuffs, what sugge tions have you to make to introduce refrigeration as a desirable method of preservation ?

Note.—In answering questions 45 and 46, kindly bear in mind the enormous econon twaste and the deterioration of grains under unsuitable storage conditions.

47. *Transport of food.*—What arrangements would you suggest in the interest of safety of the public with regard to the transport of large quantities of food over long distances ? Please indicate separately the precautions necessary in the case of perishable foods and in the case of non-perishable foods.

Are you of the opinion that the control in this respect is considerably exercised by the Central Government rather than by the Provincial Governments ?

48. *Canning dehydration.*—What controls would you suggest in canning industries and in food dehydration establishments ?

Please state the basic principles and indicate the legal powers, agency and procedure for such controls.

49. *Designs of markets.*—What are the basic requirements to be fulfilled in respect of the design and equipment of markets, wholesale and retail ? In particular, please specify the requirements for vegetable, fish, and meat markets and also for cattle and sheep markets and weekly (or periodical) bazars.

Have you been adopting any standard designs in your area ?

SECTION G.

INDUSTRIAL HYGIENE.

1. *Type of Industries : Provision for Sanitation.*—What are the prominent industries in your area ? What impression have you formed on the environmental sanitation including amenities provided in them ?

2. *Hazardous Occupations.*—Besides regular established industries, are there any special occupations which are of a hazardous nature in your locality ? Indicate the nature of the occupation and the hazard.

3. *Legal Provision for Control.*—What is your opinion about the legal provisions for regulating industries, factories and work-shops in your area, as regards their location, design, construction and maintenance ? Do you suggest any modifications or amplifications ?

Do you consider that the present agencies are adequate for the enforcement of the existing legal provisions ?

4. *Hazardous Industries & Adequacy of Precautions.*—Do you consider that hazardous industries adopt adequate precautions to prevent accidents, industrial poisoning and such like effects ?

5. *Minimum Requirements of Sanitation and Health.*—What are the absolute minimum requirements relating to sanitation and health of the workers in industries and occupations ?

6. *Present Inspectorates.*—What part does the Health Department play at present in the control of industries and factories from the health point of view ?

What is the role played by the Factory Inspectors ?

Do you consider that the training of Factory Inspectors requires any revision ?

7. *Central Control.*—What is your opinion on the relative role played by the Central Governments, Provincial Governments and local bodies in the control and regulation of industries under the existing law ?

Have you any preference as to the authority who should be entrusted with such controls ?

8. *Co-ordination among Expert Advisers.*—What suggestions have you to make to ensure co-ordination as among several experts, factory, inspectorate, health department, medical and engineering ?

9. *Industrial Environment.*—What industrial environment would you consider essential ensure efficiency of the workers ?

What special precautions would you consider as minimum particularly in cotton, wool and te factories ?

10. *Survey and Collection of Data.*—Do you recommend any form for standard survey of the ironment in industrial institutions to assess the condition in respect of—

(*i*) General conditions

(*ii*) Sanitary data

(*iii*) Ventilation

(*iv*) Illumination

(*v*) Safety hazards

(*vi*) Fumes and gases

(*vii*) Dusting processes

(*viii*) Specific poisons

(*ix*) Exposure to abnormal temperatures, dampness, radiation, noise, etc. ?

11. *Standards in Survey.*—Do you not consider that such standard survey would be greatly helpful in assessing the general sanitary environment of factories with a view to evolving, in due course, appropriate standards in respect of each of the items ?

12. *Reporting Defects.*—Do you not consider it desirable to have some agreement on the unanimity of reporting of occupational diseases with a view to having appropriate legislation passed to rectify any widespread defects ?

13. *Law and Occupational Hazards.*—Do you consider that the existing legislation requiring minimum safeguards against occupational hazards is adequate ? If not, in what respects are they defective and what suggestions have you to make to rectify the defects ?

14. *Disposal of Industrial Wastes.*—Do you consider the present position in regard to the disposal of industrial wastes, liquid and solid, satisfactory ? Do you not consider that the wastes from various industries have to be disposed of in methods appropriate to each ?

At present, who is tendering technical advice on the subject ?

Note.—For instance, waste from tanneries, paper mills, dairies, etc., has special problems.

15. *Offensive and Dangerous Trade.*—What trades, industries and occupation would you bring under the category of ' offensive and dangerous trades ' ?

What basic requirements would you suggest for each of them to ensure health and sanitation (structural requirements, fittings and maintenance) ?

16. *Control over Noise.*—Have you any specific suggestions to make to minimise evils arising from exposure to excessive noise in the factory premises and in the neighbourhood ?

Note.—The question of noise deserves special notice, as data so far available in other countries support the statement that sustained exposure to noise is a " contributing factor in impaired hearing, chronic fatigue that lowers bodily resistance, neurasthenia, increased blood pressure and decreased working and mental efficiency and that noise should rightfully be classified as an occupational hazard along with gases, fumes, dust, toxic liquids and bacteria. "

17. *Principles of Legislation.*—Can you give any specific principles which should govern the location of industrial centres to help legislation being undertaken in that behalf ?

18. *Need for Research Stations.*—In view of the fact that many problems relating to public health engineering have yet to be solved by research, do you not consider that research stations should be established under the control and direction of the Central Government in the various parts of the country ?

If you agree, how best can coordination be ensured ?

SECTION H

Prevention of Pollution of Water-Courses.

1. What are the root causes which contribute to the pollution of our water-courses ? What suggestions have you to make to eradicate them ?

2. Is the pollution of the sea shore in your area a serious problem ? If so, what are the reasons therefor and how would you remedy them ?

SECTION I.

Rodent and insect control.

1. What are the species of rats which infest the dwellings, godowns or ware-houses ? T what methods of control are they amenable ?

2. In respect of rat-proofing of buildings and godowns, what suggestions have you to make

3. In what way can a community organization help in eradicating the pest ? Is the la governing the subject adequate at present ?

4. In carrying out the engineering control works in connection with Malaria, what wou be the best economical and at the same time efficient method of constructing drains ?

What are the anti-malarial engineering works that have been carried out and with what results ? Which agencies have been responsible for carrying out such engineering works ?

Have you any legislation making it obligatory to undertake antimalarial works in your province ?

5. Do you consider that anti-malarial measures by the use of oils and larvicides and the like are efficient and enduring consistent with the cost involved ? Have you worked out the cost of the treatment by oiling or by the use of larvicides including the following items :

(*i*) Labour cost.

(*ii*) Cost of superintendence and overhead charges.

(*iii*) Operating cost of the equipment.

(*iv*) Charges for transportation of equipment, materials and workmen.

(*v*) Description of equipment.

(*vi*) Interest on equipment investment ?

Note.—This question is put to find out how far the costing data is being correctly worked out.

6. Do you consider that all the mechanical contrivances available, such as sprayers, pumps, atomisers, aeroplanes, automatic syphones and the like, should be utilised in adopting anti-malarial measures ? Have you any specific suggestions to make as to the suitability of mechanised plant to suit specific given conditions ?

7. What are your suggestions for eradicating such pests as fleas, fleas, bugs and cockroaches

SECTION J.

Camp Sanitation, Fairs and Festivals.

1. What are the types of resorts and camps which are frequented by the public now ? Do they vary materially from each other in regard to the requirements of sanitation and amenities ? According to you, what are the minimal requirements for such camps ?

2. Do you consider that care-takers should be employed in such places as a permanent measure ?

3. Is there at present any law governing their maintenance ? If not, do you consider that statutory powers are required ? If so, what points should they cover ?

4. At present, what are the provisions made to ensure sanitation and health in our fairs and festivals ? Do you consider them satisfactory ? If not, in what respects are improvements called for ?

5. What is the agency now in charge of the maintenance of the fairs and festivals

6. Do you consider that it is desirable to invoke the powers under section 144 of the Criminal Procedure Code to keep away pilgrims from any fair or festival on the ground that epidemics are raging in and around the places where fairs or festivals are to take place ?

7. Do you consider it impossible to control the environment and to prevent epidemics well in advance of the fairs and festivals and encourage people to visit such centres ?

8. Do you consider that places of pilgrimage of all-India importance require special consideration ? If they do, what special considerations would you suggest ?

9. Do you consider that places of pilgrimage should be under the control of the Central overnment, having regard to their all-India importance ?

10. What are the minimal requirements of health and sanitation which should satisfy to ve places for centres of fairs and festivals ?

SECTION K.

Control over Places of Public Resort.

1. Do you consider that minimum standards of health, sanitation and safety and amenities ld be prescribed for all such places of public resort, such as cinemas, theatres, etc. ? If so, so specifiy them.

2. Do you consider that the existing statutory provisions for the control over places of public t are satisfactory ? If not, in what respects ?

3. What agency should be held responsible for licensing and for control over maintenance ?

SECTION L.

Ventilation and Air-Conditioning.

1. Having regard to the varying climatic conditions of India, what comfort standards would you lay down ? Please give specific suggestions in regard to ventilation of dwellings, schools, factories, public offices, hospitals, etc., which vary widely in their environments ?

2. In what circumstances, would you recommend air-conditioning ?

Note.—Air conditioning required for the preservation of food may also be discussed here conveniently.

SECTION M.

General

1. Once the minimum requirements of sanitation and health are determined, would you favour their being adopted in entirety, initially in any *one* locality in district ; or, alternatively would you favour the splitting up of the development programme into several stages and the introduction of each stage simultaneously in the entire field covered by the Province or State administration ?

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2. Seeing that the sanitary conscience is deplorably lacking in our people, what suggestions have you to make to rouse their sanitary conscience and sense of community hygiene and to maintain them ?

3. Without the active, willing and continuous co-operation of the people, no headway can possibly be made in establishing and maintaining a sanitary and healthy environment. Have you any suggestions to make on the subject ?

4. How best would you educate Young India, in particular, on the importance and significance of Environmental Hygiene ?

5. Do you favour the idea of appointing a 'social worker' in each housing estate or a group of them to educate the occupants in the maintenance of the homes ?

SECTION N.

FINANCE.

1. (*a*) In view of the fact that the subjects covered under environmental hygiene are largely a matter of Provincial (State's) responsibility, would you suggest that improvement in regard to these items should be examined and decided at the time of the annual budget of the Provincial Governments, even if a plan covering a period of years has to be adhered to ?

(*b*) Would you suggest that expenditure on any of these items be made part of the capital expenditure of the Province or the State ?

(*c*) Would you suggest the creation of a fund in regard to one or more items either by earmarking a particular amount each year in the budget or by definitely setting apart certain sources of revenue for this purpose ?

(*d*) If you favour the latter alternative, what are the sources of revenue to be specifically earmarked for the purpose ?

(*e*) Would you suggest that Central Government should make subventions in regard to expenditure on one or more of these items and

(*i*) if so, what will be the nature and extent of the subvention that you would suggest ?

(*ii*) Would you be satisfied with financial provision by the Central Government for researc institutions, for training technical personnel and for the employment of techni advisers where necessary ?

(*f*) In view of the fact that the financial resources of the Units of the Indian Dominion v considerably and the needs for expenditure on these items do not always coincide with financial capacity of the Units, would you favour the Central Government supplementing the sources of the Units specifically for the purpose of expenditure on one or more of these items

(*g*) If the answer for the above is in the affirmative, would you favour the making of sub tions in regard to expenditure on these items a first charge on the amount available from o which grants are made by the Centre to the Units, apart from the revenues accruing to Ce finance out of which grants have to be made to the Units by reason of statu obligation ?

2. Do you consider the principles of property tax, which is the main source of reven municipal areas, equitable ? If your answer is in the negative, in what respects is reform for ?

(*Note.*—The question is put to elicit information whether, in the principles which at pr govern the assessment of property tax, the burden is equitable and uniform on property own s. For instance, a property having a furlong frontage involves provision of additional lengths of roads, water main sewers and electricity ; whereas for a property of equal annual rental value, with say 100 feet frontage, the provision of these facilities is obviously cheaper).

3. Do you consider that any special taxes could be imposed on owners of more than one dwelling house in addition to the normal property tax ?

SECTION O.

ORGANISATION—TECHNICAL PERSONNEL.

1. To ensure progress in environmental hygiene, do you consider that the general policy of centralised direction and decentralized control should be adopted ?

Note.—This question is set in the light of the experience of Soviet Russia which has shown enormous progress in a brief period following this policy.

2. Do you agree that central direction at high levels should be in the hands of highly qualified and experienced experts ? If you agree, what central organization would you suggest and what organization for decentralised execution would you propose at the Provincial level and at all levels below it ?

3. All along the line, from the Centre down to the district levels, there should be co-ordination between Medical (Preventive) and Public Health Engineering Departments delimiting their respective functions at the same time. How can it be achieved ?

4. In the organization of the Public Health Engineering service, what principles should govern the various classes of personnel and their number ?

5. Do you consider that there should be research in the field of Public Health Engineering ? If so, do you agree that the research should be under the direction of the Centre and the responsibility thereof should be with the Central Government ?

6. Do you not consider that the organization of technical personnel should be the pivot of any plan to improve enviromental hygiene ?

7. Do you not consider that a high priority should be given for training of the personnel ? If you do, is it not necessary to standardise the training of Public Health Engineers ?

8. Do you consider that the training of Public Health Engineers should be under the direction of the Central Government ?

If you do, how would you distribute the financial burden between the Centre on the one hand and the Provinces and the acceding States on the other ?

9. Do you consider that any Provincial centres, which should be opened for training Public Health Engineers, should comply with the requirements which the Central Government may etermine from time to time ?

10. In the alternative, would you favour the training of Public Health Engineers being en- sted to Universities ?

11. Do you consider that Engineering Colleges in which the teaching staff are divorced m executive field experience can usefully undertake the responsibility of training Public lth Engineers ?

12. In the training of this class of officers, would you favour the training being divided into specific sections : (1) basic engineering training and (2) special training in all matters re- g to public health ?

13. In your opinion, what subjects should be included in the syllabus for basic training and subjects for specialised training ?

4. What should be the duration of the training in basic engineering knowledge and in the al course ?

5. What methods would you recommend to ensure practical training being given to the dates ?

6. Would you favour "articled pupilage" for training Public Health Engineers ?

7. Would you make it obligatory on the part of engineering firms, which execute major w -supply and drainage schemes, to take a specified number of engineering students for their pr cal training ?

18. In view of the fact that our country cannot afford to have expensive technical personnel to man public health engineering departments, would you favour a service being organized on principles different from those on which other permanent services are organised ? If so, please outline your proposals.

19. Would you favour the public health engineering department being manned by one class of officers without any distinction of "gazetted" and "non-gazetted" ?

20. In the Medical department, only one class of officers with adequate standardised training is envisaged. That being so, is it desirable to bring about 'caste distinctions' as it were in the public health engineering service ? If you consider that filed subordinates may be given the training of lower order, will you specify in what respects the standards of training could be lowered and what opportunities would you afford to them to qualify themselves as public health engineers in due course ?

21. In the recuritment for the public health engineering service, what terms and conditions would you specify ?

Note.—In answering this question, kindly bear in mind that our financial resources are imited and that we cannot afford to recruit men for the service on high scales of salary. The possibility of organising this service as a 'social service' providing, for the members of the service, a minimum and uniform scale of salary, free housing and conveyance, free education of children up to a limit, free medical attendance and insurance, may be considered.

22. Having regard to the experience of the recommendations of the special committee constituted by various Governments, do you not consider that some definite permanent organisation should be set up to watch the progress, to speed up implementation of the recommendations and above all to study difficulties as they arise and suggest solutions for the administration concerned ?

APPENDIX II.

(*Vide* Chapter I, paragraph 6)

List of authorities and persons from whom replies to the questionnaire were received.

1. Ministry of Health, Government of India, New Delhi.
2. Ministry of Agriculture, Government of India, New Delhi.
3. Ministry of Education, Government of India, New Delhi.
4. C.G. Kale, Esquire, Technical Adviser, Rehabilitation and Development Board, Ministry of Rehabilitation, Government of India, New Delhi.
5. P.C. Khanna, Esquire, Director, Railway Board, Ministry of Railways, Government of India, New Delhi.
6. J.D. Shastri, Esquire, Senior Architect, Directorate-General of Health Services, New Delhi.
7. Engineer-in-Chief, Army Headquarters (India), New Delhi.
8. Lt.-Col. Jaswant Singh, Director, Malaria Institure of India, Delhi.

8A. Director, Central Research Institute, Kasauli.

9. Chief Adviser of Factories, Ministry of Labour, New Delhi.
10. Consulting Engineer to the Government of India (Roads), Roads Organisation, Ministry of Transport, New Delhi.
11. Medical Officer of Health, New Delhi Municipal Committee, New Delhi.

11A. Medical Officer of Health, Notified Area Committee, Delhi.

12. Principal, Delhi Polytechnic, Delhi.
13. Lands Officer, Delhi Improvement Trust, New Delhi.
14. Honorary Secretary, Institution of Engineers (India), New Delhi.
15. Indian Board of Town Planners, Chuna Mandi, Pahar Ganj, Delhi.
16. Dr. R.M. Mathew, Director of Public Health, Madras.
17. C. Narasimham, Esquire, Commissioner, Corporation of Madras, Madras.
18. Health Officer, Corporation of Madras, Ripon Buildings, Park Town, Madras.
19. A. Raghava Reddi, Esquire, Acting Chairman, Madras City Improvement Trust, Madras.
20. A.B. Venkatachari, Esquire, Chief Engineer, P.W.D. (Irrigation), Chepauk, Madras.
21. K.V. Sundaram Ayyar, Esquire, Government Analyst, Guindy, Madras.
22. Dr. R. Adishesham, Director of Public Health (Retired), Madras.
23. L.M. Chitale, Esquire, Chartered Architect and Town Planning Consultant, Madras.
24. Dr. R. Subrahmanyam, Professor of Hygiene, Madras Medical College, Madras.
25. Registrar, Andhra University, Waltari.
26. Chief Engineer, P.W.D., Trivandrum.
27. Registrar, Annamalai University, Annamalainagar.
28. Dr. D. Joseph, Municipal Health Officer, Tiruchirappali Municipality, Tiruchirappali, ras.
29. Dr. R. Sambamurthu, Health Officer, Madura Municipality, Madura.
30. Dr. N. Nataranjam, Municipal Health Officer, Kumbakonam.
31. S. Nachimuthu Goundar, Esquire, Municipal Commissioner, Udamalpet.
32. Chief Medical Officer, South Indian Railway, Trichy.
33. District Engineer, South Indian Railway, Podanur.
34. Chief Engineer, South Indian Railway, Trichinopoly.
35. J.S. Ramamurthy, Esquire, Principal, Andhara Polytechnic, Kakinada.
36. Principal, New Engineering College, Sangli.
37. R.D.N. Sihmam, Esquire, Joint Director of Town Planning, Madras.
38. Chief Engineer for Irrigation (General Branch), Madras.
39. Lt.-Col. M.G. Bhandari, Surgeon-General with the Government of Bombay, Bombay.
40. Consulting Sanitary and Hydraulic Engineer, Government of Bombay, Poona.
41. Consulting Surveyor to the Government of Bombay, Poona.

42. G.B. Soparkar, Esquire, Ex-Consulting Surveyor to the Government of Bombay, Bombay.

43. N. Sanyal, Esquire, Sanitary Engineer, G.I.P. Railway, V.T. Bombay.

44. B.K. Modak, Esquire, President, Borough Municipality, Kalyan.

45. Principal and Secretary, Victoria Jubilee Technical Institute, Bombay.

46. Public Health Engineer, Bombay Government, Poona.

47. Director, Public Health, Poona.

48. Director, Haffkine Institute, Bombay.

49. Divisional Engineer, G.I.P. Railway, Bhusawal.

50. Health Officer, Ahmedabad Municipality, Ahmedabad.

51. Medical Officer of Health, Kurla Borough Municipality, Kurla.

52. Chief Engineer, B.B. & C.I. Railway, Churchgate, Bombay.

53. Registrar, Bombay University Bombay.

54. Municipal Engineer, Ahmedabad Municipality, Ahmedabad.

55. Education and Industries Department, Government of Bombay, Bombay.

56. Labour Department, Government of Bombay, Bombay.

57. B.V. Bhoota, Esquire, Dorr Company Engineer.

58. Home Department, Government of Bombay, Bombay.

59. N.P. Gurjar, Esquire, Chief Engineer and Secretary to the Government of Bombay, P.W.D. (Irrigation), Bombay.

60. Chief Medical Officer, Bombay.

61. J.K. Adranwala, Esquire, Medical Officer of Health, Poona City Municipality, Poona.

62. Dr. S.N. Lahiri, Principal, Medical and Health Officer.

63. Municipal Commissioner for the City of Bombay, Bombay.

64. Director of Health Services, West Bengal, Calcutta.

65. Health Officer, Corporation of Calcutta, Calcutta.

66. Chief Inspector of Factories, West Bengal, Calcutta.

67. Labour Commissioner, West Bengal, Calcutta.

68. Registrar, Calcutta University, Calcutta.

69. Chief Medical Officer, E.I. Railway, Calcutta.

70. M. Maitra, Esquire, Ex-City Architect, Corporation of Calcutta, Calcutta.

71. Chairman, Khardah Municipality.

72. Senior Superintendent, Way and Works, Asansol.

73. Chairman, Champdani Municipality.

74. Chairman, Kandi Municipality.

75. Anti-Malaria Engineer, Public Health Engineering, Calcutta.

76. Chairman, Burdwan Municipality.

77. Dr. A.C. Banerjee, Director of Medical and Health Services, United Provinces, Luc[illegible].

78. Chief Engineer, Public Health Engineering Department, United Provinces, Luck[illegible].

79. R.D. Trudgett, Esquire, Town and Village Planner to United Provinces Govern[illegible]t, Lucknow.

80. Dr. D.D. Bhargava, Medical Officer-in-Charge, Provincial Hygiene Institute, United Provinces, Lucknow.

81. Pulin Behari Banerjee, Esquire, Chairman, Improvement Trust, Lucknow.

82. Executive Engineer, Improvement Trust, Lucknow.

83. Registrar, University of Lucknow, Lucknow.

84. D.C. Desai, Esquire, Senior Superintendent, Way and Works, Lucknow Division, E.I. Railway, Lucknow.

85. K.N. Singh, Esquire, Labour Commissioner, United Provinces, Kanpur.

86. Mohan Lal Nehru, Esquire, Chairman, Allahabad Improvement Trust, Allahabad.

87. J.P. Mehta, Esquire, Chairman, Municipal Board, Banaras.

88. Principal Medical Officer, Oudh and Tirhut Railway, Gorakhpur.

89. Medical Officer of Health, Municipal Board, Jaunpur.

90. Dr. M.L. Sharma, Municipal Medical Officer of Health, Bahraich (Oudh).

91. Bishan Singh, Esquire, Resident Engineer, Gonda.

92. Chairman, Municipal Board, Kairana.

93. Co-operative and Rural Development Department, Government of Central Provinces and Berar, Nagpur.

94. L.V. Chhatre, Esquire, Public Health Engineer, Central Provinces and Berar, Nagpur.

95. Assistant Town Planning Expert, Central Provinces and Berar, Nagpur.

96. Registrar, Nagpur University, Nagpur.

97. Principal, Government Engineering College, Jubbulpore.

98. Medical Officer of Health, Municipal Administration, Raipur, C.P.

99. Officer-in-Charge, Municipal Committee, Jubbulpore.

100. President, Municipal Committee, Damoh.

101. Medical, Local Self Government and Industries Department, Government of East Punjab, Simla.

102. S.R. Mehra, Esquire, Superintending Engineer, Development Circle (South), East Punjab, P.W.D., B. and R. Branch, Ambala Cantt.

103. Director of Public Health, East Punjab, Simla.

104. D.C. Khanna, Esquire, Superintending Engineer, Public Health Circle, East Punjab.

105. Honorary Secretary, Institution of Engineers, Punjab Centre, Ambala Cantt.

106. Inspector General of Civil Hospitals, East Punjab.

107. Assistant Director of Public Health, Ambala Range, Ambala.

108. Principal, Engineering College, Ludhiana.

109. Chief Administrative Officer, East Punjab Railway, Delhi.

110. P.C. Khanna, Esquire, Assistant Provincial Town Planner, East Punjab.

111. Lt.-Col. A.N. Chopra, Director of Public Health, Assam.

112. D.C. Das, Esquire, Development Commissioner to the Government of Assam, Co-ination Department, Assam.

113. Director of Pasteur Institute, Shillong.

114. District Medical Officer, Headquarters, Assam Railway, Gauhati.

115. District Medical Officer, Assam Railway, Lumding.

16. Executive Engineer, Assam Railway, Sorbhog.

17. S.N. Chakravarti, Esquire, Public Health Engineer, Assam, Shillong.

18. Lt.-Col. B.N. Hajra, Director of Health and Inspector General of Prisons, Orissa, ck.

19. Principal, Orissa School of Engineering, Cuttack.

20. Registrar, Utkal University, Cuttack.

21. Chairman, Jajpur Muncipality, Cuttack.

22. Health and Local Self Government Department, Government of Orissa, Cuttack.

3. Lt.-Col. A.N. Duggal, Director of Public Health, Bihar.

4. H. Whipp, Esquire, Superintending Engineer, I/C Public Health Engineer's Office, B

125. Lt.-Col. D.P. Nath, Inspector-General of Civil Hospitals, Bihar, Patna.

126. V.N. Prasad, Esquire, Government Architect and Town Planner, Bihar.

127. M.L. Bahl, Esquire, Chief Engineer (E. & R.), Patna.

128. Principal, Bihar College of Engineer, Patna.

129. Registrar, Patna University.

130. Chief Inspector of Factories, Patna.

131. Special Officer, Industrial Housing Scheme, Patna.

132. Chairman, Lohardaga Municipality, Lohardaga.

133. Civil Surgeon, Ajmer-Merwara, Ajmer.

134. K.L. Sheth, Esquire, Officer on Special Duty for creation of I mprovement Trust, Ajmer.

135. Dr. T.B. Medappa, Civil Surgeon of Coorg, Merwara.

136. Chairman, Municipal Committee, Ajmer.

137. Extra Assistant Commissioner, Beawar.

138. Sub-Divisional Officer, Kekri.

139. Director of Public Health, Mysore State, Bangalore.

140. Commissioner of Labour in Mysore State, Bangalore.

141. Chief Engineer for Roads and Buildings in Mysore State, Bangalore.

142. C.N. Shama Rao, Esquire, Superintending Engineer (Retired), Bangalore.

143. Sanitary Engineer, Bureau of Sanitary Engineering, Bangalore.

144. Registrar, University of Mysore, Mysore.

145. C.N. Narasinga Rao, Esquire, Chairman, City Improvement Trust Board, Bangalore.

146. Dr. C.F. Chenoy, Director of Public Health, Hyderabad State Government, Hyderabad-Deccan.

147. D.V. Rao, Esquire, Chief Engineer, District Water Works, Wells Sinking and Local Government Departments, Hyderabad-Deccan.

148. M. Fayazuddin, Esquire, Chief Town Planner, Hyderabad State Government, Hyderabad-Deccan.

149. Chandulal C. Dangoria, Esquire, Retired Superintending Engineer, C.I.B., Hyderabad-Deccan.

150. D.N. Dhar, Esquire, Kashmir State Architect and Town Planner, Srinagar.

151. Sanitary Commissioner, Baroda State, Baroda.

152. Municipal Commissioner and Health Officer, Baroda State, Baroda.

153. State Architect and Chief Engineer, Baroda State, Baroda.

154. Commissioner, Municipal Council, Cochin.

155. Principal, Sawai Man Singh Medical College, Jaipur.

156. Chief Secretary, United States of Rajasthan, Udaipur.

157. Government of Matsya, Alwar.

158. Government of Cochin, Ernakulam.

159. Director of Medical and Health Services, Government of Madhya Baharat, Moti-Mahal Lashkar (Gwalior).

160. Sanitary Engineer and (Ex-Officio) Chairman, Town Improvement Trust, Gwalior Government, Gwalior.

APPENDIX III

(*Vide* Chapter I, para 8.)

List of persons interviewed.

1. Hon'ble Dr. T. S. S. Rajan, Food Minister, Madras.
2. C. G. Reddi, Esquire, Labour Commissioner and ex-officio Chief Inspector of Factories.
3. R. N. Mathew, Esquire, Director of Public Health, Madras.
4. R. D. S. Simhan, Esquire, Joint Director of Town Planning.
5. M. Meeran, Esquire, City Engineer, Corporation of Madras, Madras.
6. Dr. R. Adisheshan, Retired Director of Public Health, Madras.
7. Rao Sahib Dr. Ananthan Pillai, Assistant Director of Vital Statistics and Environmental Hygiene.
8. K. M. Unnitha, Esquire, Inspector of Local Bodies and Municipal Councils, Madras.
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57. Priya Datt Ram, Esquire, Chairman, Municipal Board, Faizabad.
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60. V. C. Mehta, Esquire, Chief Engineer and Town Planner, Development Board, Kanpur.
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93. Dr. S. Misra, Assistant Director of Public Health (States), Cuttack.

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95. N. C. Pradhan, Esquire, Chairman, District Board, Cuttack.

96. P.C. Mohanty, Esquire, Municipal Health Officer, Cuttack.

97. Dr. B. Misra, Assistant Director of Public Health, South Orissa, Cuttack.

98. Dr. S. R. Padhi, Executive Engineer, Bhubaneswar.

99. J. N. Misra, Esquire, Chairman, District Board, Puri.

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107. Director of Public Health, Assam.

108. Chairman, Shillong Municipal Board.

109. Public Health Engineer, Assam.

110. Director, Rural Development, Assam.

111. Health Officer, Shillong.

112. Civil Surgeon, Kamrup, Gauhati.

113. Assistant Director of Public Health, Gauhati.

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115. Dr. Bhubaneswar Barua, M.B.

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117. Dr. J.C. Das, M.B.

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126. G. N. Narasinga Rao, Esquire, Chairman, City Improvement Trust Board, Bangalore.

127. C. N. Shama Rao, Esquire, Superintending Engineer (Retd.), Water Supply, c/o Chair- n, Improvement Trust, Bangalore.

128. C. Subha Rao, Esquire, Govt. Architect and Town Planning Officer, Bangalore.

129. R. Madhavan, Esquire, Engineer Officer, City Improvement Trust Board, Bangalore City.

APPENDIX IV

(*Vide* Chapter III, paragraph 31)

Summary of recommendations made by other Committees regarding minimum standards of health healthful housing.

I. *Health Survey and Development Committee.*

(*a*) The following minimum standards of housing are required for the health of the industrial worker and his family.

(*i*) For a single man : a room 10 ft. × 12 ft. × 10 ft. and a verandah 8 ft. × 8 ft. × 10 ft. for a group of such quarters there should be provided community kitchens, latrines and bathing places in accordance with the standards to be prescribed by the Provincial Government. Where common kitchens are not provided, provision should be made for choolas on the verandahs with suitable chimneys for the outlet of smoke. Where latrines and bathing places for common use are erected, they should be at a reasonable distance from the quarters and, if possible, connected by a covered way for protection during bad weather.

(*ii*) For a family : for a married couple two rooms 10 ft. × 12 ft. × 10 ft. with a verandah, kitchen, bath-room and latrine. For a family incuding grown up children the accommodation should be increased by at least one extra room of similar size.

(*b*) In regard to sanitary conveniences, as far as possible, septic tank and soil distribution systems should be introduced so that the handling of night soil may be avoided.

II. *Industrial Housing Sub-Committee of the Standing Labour Committee.*

A house to accommodate an industrial worker and his family should comprise at least—
2 rooms,

a kitchen with storage space for food and fuel,

an independent bath room,

a lavatory,

verandahs, preferably both in front and at the back and a courtyard in the case of single storey houses, and be provided with an adequate supply of water and where possible with water borne sanitation.

Standard of accommodation.—(*a*) The total floor area of the two main rooms, exclusive of verandahs, should not be less than 240 sq. ft.

(*b*) The height of the two main rooms should not be less than 10 ft. measured from the floor to the lowest part of the ceiling, and neither of the the two main rooms should have a cubic capacity of less than 1,000 c.ft.

(*c*) At least one verandah, and preferably both, should be not less than 7 feet wide.

(*d*) Shelves should be provided in the kitchen for keeping utensils and built-in-shevles or almirahs provided in the main rooms.

Standrd of ventilation. (*a*) An efficient form of top ventilation should be provided.

(*b*) The main rooms should be provided with doors and windows providing adequate cross and through ventilation.

(*c*) It is most desirable that houses be so designed that the two main rooms are not one behind the other. Where this is not possible, ample ventilation to the outside air should be provided in both rooms.

(*d*) The kitchen should be provided with a chimney or a flue and a well designed chulah economical in fuel.

Standard of Lighting.—(*a*) The window opening in each of the main rooms and in the kitchen exclusive of doors and opening to the outside air, should not be less than 10 per cent. of the floor area of the room.

(*b*) Electrical light should be provided wherever possible.

(*c*) Every house should be white-washed at least once a year.

Sanitation and Drainage.—(*a*) A family lavatory, not a common lavatory, is to be preferred on all grounds, social and hygienic. It is frequently stated that when lavatories are provided they are not made use of. There is a great deal of evidence that where such circumstance

...s. the failure to utilise proper sanitation lies in objections to the use of common latrine, poor maintenance and a low standard of cleanliness. Family latrines where they have been provided have rapidly become very popular.

(b) All drains other than sullage drains, which must be installed under-ground, should be "pucca" and, unless there are exceptional circumstances justifying some other course, covered and underground.

(*a*) Houses should not be built back to back and it is most desirable that blocks of houses be limited in size, and wherever possible laid out on the lines of a garden city.

(*b*) Houses should be allocated on the basis of one family to one house. Any family houses remaining surplus after meeting fully the requirements of married workers may be allotted to single workers on the basis of four workers to a house.

(c) Provision against subletting and taking in boarders should be made by formulating suitable tenancy conditions and providing adequate machinery for their enforcement.

Dormitories.—Where provided, they should conform to the general principles of planning and the sleeping space for each person should not be less than 50 sq. ft., this space being in addition to the provision of common dining rooms, baths, lavatories, etc. Dormitory accommodation should not be let to families or to persons of different sexes.

Dormitory accommodation should not be let to families or to persons of different sexes. The built up area shall not exceed 1/4 to 1/3 of the plotarea. The marginal spaces whereof shall not be less than 15 feet.

III. *Housing Sub-Committee of National Planning Committee.*

The floor area including that of verandah will be at least 60 sq. ft. per adult. The aim of the National Planning Committee is 100 sq. ft. Though this is desirable, it has been found that under the present economic circumstances, 50 sq. ft. can only be fixed as the minimum.

The minimum height shall be 9 ft. clear. The rooms shall have at least an external wall abutting an open space ; openings for light and ventilation shall be 1/7 of the floor area, excluding door area. There should be thorough ventilation. Each family shall have one bath and one latrine on the water carriage system, with proper ventilation and adequate equipment.

Staircases and passages and corridors to be of a minimum width of 3 ft. and 4 ft. respectively f the fire-proof costruction with proper light and ventilation. Lift shall be provided for a builing more than 40 ft. high and having more-than three stories.

Every unit shall have at least two separate exits and there should be convenient ingress nd egress.

Though detached houses may be preferable, semi-detached ones will in some cases be pracal. In most of the cases, however, row-type structures will be necessary; this shall have not ore than 20 tenements distributed over two floors at the maximum. Multiple storyed buildings ll be adopted only where land cost is very high or there is absolute absence of suitable land.

The accommodation for a family should preferably be as under :

Main Room ..	.. 15′ × 10′	=150 sq. ft.
Kitchen ..	.. 8′ × 6′	=48 sq. ft.
Verandah ..	.. 9′ × 6½′	=58½ sq. ft.
Bath Room	.. 7′ × 3½′	=24½ sq. ft.
W.C. ..	.. 4′ × 3′	=12 sq. ft.

Materials.—External walls and roofs should give protection from weather in all seasons of year.

Floor should be as impervious as possible but such as would not induce cold and the like Unglazed tiles, properly maintained mud floor, lime concrete and the like are suggested for the floor but a detailed study to find out a suitable paving materials is necessary. Attempts have to be made to get a roof of low thermal conductivity in addition to its being rain-proof.

Fixtures and Fitments.—The question presents more varied problems than that of the house according to the mode of living of the occupant, climate and the like. Indian workers like to have built-in fixtures and fitments, unlike their comrades in foreign countries. The question therefore, becomes more important as these should be inserted in the building beforehand. A typical list for normal requirements is given below :—

(1) Washing basins. (2) Cleaning platform. (3) Fire place with cooking platform. (4) Loft. (5) Provision racks. (6) Fuel bin. (7) Drying bars. (8) Shelves. (9) Pegs. (10) Roof pendents. (11) Cupboards. (12) Kit platform. (13) Water place. (14) Niches. (15) Swing rings. (16) Shoe recess. (17) Curtain hangers. (18) Grinding stone.

Care shall have to be given to the sanitary requirements such as washing and cleaning arrnagements, removal of domestic refuse, cooking arrangement, proper plumbing, hygienic storage, vermin prevention, fire protection, proper upkeep and the like.

Density of population should not be more thn 100 persons per gross acre. This will mean 20 to 25 tenements per acre.

IV. *Housing Panel on Greater Bombay Scheme.*

The minimum covered floor-space per family tenement should not be less than 250 square feet, i.e., no family tenement should be smaller in size than 250 square feet, exclusive of the verandah and W.C. and not more than 4 persons should be permitted to live in such a tenement.

On an average the minimum covered floor area per person should be 60 square feet in the family tenements, and where the number of inmates in a family exceeds 4, tenements of correspondingly larger accommodation should be provided. The Panel would suggest tenements of 360 and 420 square feet of floor space for families of 5 to 6 and 7 to 8 persons respectively.

Every family tenement should have at least 2 living rooms, a kitchenette, an open verandah (preferably independent as far as possible), a Water Closet, a Nahni with a water tap and a loft for the storage of articles.

The following amenities should be provided in each tenement—

1. A built-in cupboard,
2. A shower in the Nahni,
3. A small mori for washing in the kitchenette,
4. A raised platform for fire-place with a Hood and Chimney to carry away smoke and a hollow underneath the platform to store fuel,
5. Pegs for hanging clothes,
6. Shelves in the kitchenette for keeping utensils,
7. A minimum of 3 electric lights in each of the smaller tenements.

For every 4 tenements of the size of 250 square feet, 1 common Washing Place with a tap should be provided.

The common Washing Places, staircases and access verandahs or passages should be provi- ded with electric lights.

Whereas the wiring on the smaller tenements with the minimum of 3 electric lights may [illegible] attached to the common chawl meter, each of the larger tenements may be provided with a s[illegible] parate electric meter, if possible, so that the tenents may pay their own electricity charges a[illegible] cording to consumption and the necessity of shutting off and opening electric current at particu[illegible] hours and the difficulty of collecting charges, removing and replacing bulbs, etc. may be obviat[illegible]

The existing one-room and one-room and kitchen should be so remodelled wherever possil[illegible] as to allow for the minimum floor-area of 250 square feet per tenement and provide for the ame[illegible] ties proposed above.

If the tenements are too old or beyond remodelling or improvement, there should be le[illegible] lation enacted for enforcing their demolition and rebuilding on revised plans.

The Houses to be constructed in the City should be of ground and three upper floors and [illegible] terrace should be made accessible to the residents so that in the hot weather they can sleep ther[illegible]

(If not too costly, some portion of the terrace may be covered with a low-pitched roo[illegible] protection against the inclemencies of weather, so that it can be used all the year round).

The Houses in the Suburban area should be of round and one upper floor with a terrace [illegible] vided and made available to the tenants as above.

As regards the larger tenements for 5 or more persons each, there should not be more than 8 tenements on each floor of a building and as regards the tenements of the minimum inside area of 250 square feet, there should not be more than 8 tenements on each floor, served by a single staircase.

As far as possible, the verandah may be independent for each tenement so that its exclusive use could be ensured to the respective occupants.

In the central part of the City, that is, within a radius of about 4 miles from the Arthur Crawford Market, i.e., upto about Parel in the North and Colaba in the South, the ratio of built up plot area to unbuilt should be 1/3 to 2/3 (or 33⅓ per cent.: 66 2/3 per cert.), and the ratio beyond that radius to the north of the City upto Mahim-Sion and in the Suburbs should be ¼ to ¾ (i.e., 25 per cent to 75 per cent).

V. *Madras Provincial Housing Committee.*

Minimum living space.—The minimum floor (carpet) space required for a dwelling house of six inmates should be 340 sq. ft. including verandahs and the mean floor area per adult 75 sq. ft. and 40 sq. ft. per child under ten years.

Minimum floor area of a living or bed room.—The minimum floor area of a living or bed room should preferably be 120 sq. ft. but in no case should it be less than 80 sq. ft. and at least one room should not be less than 120 sq. ft.

Height of room.—In the case of sloping roofs, the minimum height of 9 feet is recommended, this being measured at the junction of the outer wall and the roof on the inner side of the house. In the case of flat roofs, the mimum height should be 10 feet.

Plinth level.—The minimum plinth level should be 18 inches above the level of the centre of the nearest street.

Doors.—Doors are of various widths and heights of depending, of course, on the position occupied. External doors should as a rule, be wider than internal ones. Outisde doors are generally hung so as to open inwards. Inside doors should open away from anyone entering the room and must be hung so as to protect the room as much as possible from draughts when open. In bed rooms the doors should, when open, screen the portion of the bed and in bath rooms and water closets, to secure privacy even when accidentally open.

The height of the doors should not be less than 6 feet 3 inches but should preferably be not less than 6 feet 9 inches for main doors. The width should not be less than 3 feet for main doors but may be as little as 1 foot 9 inches for bath rooms.
The following standard specifications are recommended—

(*a*) The basic outside dimensions should be as follows —

(*i*) For doors without ventilating heads—height (no sills) 6 feet 9 inches, width 4 feet.

(*ii*) For doors with ventilating heads—heights 8 feet 6 inches (no sills), width 4 feet.

(*b*) (1) Doors 2 feet 6 inches may be single-leaved and used for dressing rooms, outside doors for kitchen, doors to bathing rooms, etc.

(*ii*) Doors with 1 foot 9 inches width may be used for lavatories, water closet, fuel room, etc.,

(*c*) Door shutters should be standardized as follows :—

(*i*) External doors—Panelled shutters—glazed 1/3 top section if there are no ventilating heads.

(*ii*) Internal doors—panneled shutters—except for bath rooms and water closets which may be braced and battened for economy.

Windows and ventilation.—This area for windows and ventilators should, in no case, be less [th]n one-sixth of the floor space. But it is desirable that ventilators, when provided, should not [be] reckoned in the ventilating area.

The following standard specifications are recommended :—

(*a*) The basic dimensions should be as follows—

(*i*) For windows without ventilating heads—height 4 feet 6 inches by 3 feet 6 inches.

(*ii*) For windows with ventilating heads—height 6 feet 3 inches by 3 feet 6 inches.

(*b*) External windows—panelled shutters—opening outwards with glazed shutters on the [ins]ide for all outer windows.

Kitchen.—This should not be less than 60 sq. ft. in area. If combined with stores, it should have an area of at least 80 sq. ft.

Bathing room.—The bathing room should not be less than 24 sq. ft. or of the dimensions 6 feet by 4 feet.

Lavatory.—The lavatory should be of the minimum size of 16 sq. ft. and not less than 3 feet in width. Water-closets should be provided wherever feasible. Dry latrines should be avoided as far as possible. Aqua privy or similar septic type l trines should be used in preference.

Kudams or verandahs.—It is essential that kudams or verandahs, when provided, should be adjacent to the kitchen wherever possible, as the house-wife has to spend most of her working hours there.

Amenities to be provided for each house.—The following amenities should be provided in each house:—

(*i*) A built-in-cup-board in each bed and living room.
(*ii*) Pegs for hanging clothes.
(*iii*) Shelves in the kitchen for keeping utensils and supplies.
(*iv*) A raised platform for fire place with a chimeny to serve as smoke outlet.
(*v*) Adequate supply of pure water.
(*vi*) Compound wall or line fence.
(*vii*) Independent bath rooms, bath water being led away to underground drains or distributed over as large an area of land as possible.
(*viii*) Latrines fully sanitated and connected to underground drains or septic tanks and dispersion trenches.

The standards recommended above should be applicable to all construction whether undertaken by public or private contractors, individual, building societies, Government, local bodies, etc.

VI. *Standard recommended by the Railway Board Committee under the Chairmanship of Mr. N. K. Mitra to report on the Scheme for the Provision of Quarters for the Railway Staff.*

(1) The minimum accommodation in any railway house must be two-rooms and a verandah with a total floor space of not less than 325 square feet. This will be exclusive of a kitchen, bathing place and storage accommodation. This area will be in keep with the British standard which will require (110+110+90) 310 square feet for a family of five.

(2) An additional room, however, will be necessary in some cases with grown up children as otherwise separation of sexes is not possible.

(3) Regarding the size of a living room, a dimension of 12 feet × 10 feet as the minimum is recommended.

(4) For a gable roof, 12 feet at the centre and 9 feet at the eaves are recommended. For flat roof the height should not be less than 11 feet.

(5) Minimum plinth level 18″ above ground level is recommended.

(6) The height of door should be not less than 6 feet 3 inches but should preferably be n[illegible] less than 6 feet 9 inches for main doors. The width should not be less than 3 feet for main doc[illegible] but may be as little as 1 foot 9 inches for bathrooms. For window openings a minimum [illegible] 1/6th is recommended. Ventilators provided separately.

(7) No special arrangment need be made where bottom sills for doors or windows are provided as there would be sufficient space to allow the necessary inflow of air.

(8) No kitchen should be of an area less than 60 square feet. The back verandah near kitchen should not be less than 7 feet wide and 12 feet long.

(9) Fire places are to be provided in living rooms only at stations which have winter [illegible]perature below 40° F.

(10) All main walls 10 inches in brick-work in lime and partition walls 5 inches in cemer[illegible]

(11) Roofing especially of Jack arch supported on second hand rail beams over main ro[illegible] verandahs and kitchen and R.C. slap or asbestos sheet over shed, bath and privy.

APPENDIX V

(*Vide* Chapter XVI, paragraph 35).

Record of discussions between the Environmental Hygiene Committee and Dr. G. Sankaran, Professor of Biochemistry, Nutrition and Physiological Hygiene, All India Institute of Hygiene and Public Health at Calcutta on the 28th February 1949.

Chairman.

We understand that you have investigated, during your recent deputations to Europe and America, the possibility of India producing certain chemicals, pharmaceuticals, etc. Could you kindly let us know if any of your schemes are likely to help our Committee in implementing our recommendations ?

Dr. Sankaran.

I thank you, sir, for honouring me by asking me to tell the Committee of the possible value of my investigations in furthering the improvement of Environmental Hygiene of our country. I must however explain that my primary interests are in production of foods ; I believe that Agricultural production of these in India has its limitations and that, if we want to make ourselves self-sufficient with regard to these, we have to employ industrial methods, especially chemical engineering, My views on this have been presented in several of my reports submitted to various committees. Most of my suggestions for solution of our food problems are based on the successful practices of other progressive countries of the world who are as unfortunate as India with respect to food sufficiency. Germany in particular has produced a very large tonnage of protein food of high nutritive value in the form of food yeast in factories. In this effort Germany has been a pioneer once again, having previously successfully achieved self-sufficiency f nitrogenous fertilizers for the soil. Germany also produced during the recent war large uantities of edible fat from the cheap raw material brown coal. This was again by an industrial rocess in factories. By a strange coincidence edible fat was made out of a by-product obtained the production of Aviation petrol and lubricating oils. While these two achievements concern vo of the important food elements, required in large amounts the more recently determined sential food factors, vitamins, have also been produced in the last decade in industrial quan-ies of hundreds of tons. The developments in these latter products afford an interesting study integrated chemical industry. Vitamins are organic chemicals, some of them complex in ucture and some very simple molecules. All these require for large-scale production easy ilability of a variety of chemicals ordinarily designated heavy chemicals and derived from the owing few basic raw materials, namely, coal, salt, limestone, brimstone (sulphur), nitrogen atmosphere) and water. Vitamin production as practised at the present moment in Europe America indeed is dependent on a well developed basic heavy chemical industry. When as realised that India required considerable production of vitamins, it became apparent that uld not be achieved due to the lack of this basic chemical industrial development. My stigations of the industrial developments in vitamin production largely came to be a study emical industries over a wide field. Further, vitamins are organic molecules like many other strially produced chemicals, such as pharmaceuticals and drugs. They also resemble dye s and hormones of animals and plant origin. All these at one time were extracted from rally occurring or grown material. They are now, however, more economically produced nthetic processes from simpler chemicals. These developments have largely helped in the ssful production of vitamins. Incidentally many chemicals used as " intermediaries " e making of dye-stuffs, pharmaceuticals and vitamins proved to be " intermediaries " ll of plastics and insecticides. It is thus now possible to have factories capable of producing maceuticals, dye-stuffs, vitamins, hormones, insecticides and plastics by a planned integra-of materials and processes. Such an integration has considerable economic advantages. utilisation of a certain by-products of heavy chemical industries which at one time were a glut can now be turned into valuable products fetching a good price. Certain plants considered uneconomic can now be worked with profit. This, however, can only be achieved if industrial chemists have a wide background of knowledge. Deep specialisation in limited chemical industrial activity will be a detriment to planned integration. This has unfortunately happened in the near past and even today many specialist experts declare that when alkalis are produced chlorine becomes a gult, rendering the plant uneconomic. This could not be true if we require to produce DDT in sufficient quantities. You members of the Environmental Hygiene Committee, I am sure, require in addition to DDT other chlorine-containing substances in very large quantities, such as gammexane and bleaching powder or even elemental chlorine for rendering water supplies suitable for human use and consumption as well as to render sewage safe for disposal. If after all this use there is still excess of chlorine plastic can be produced of which it is difficult to have too much. Based on such considerations, I have drawn up a scheme of sixteen integrated industrial organisations (list appended) primarily designed to produce food-stuff

but incidentally producing pharmaceuticals, hormones, insecticides and plastics. In it you will find all the insecticides, rodenticides, etc., needed for the improvement of environmental hygiene. Any others you find missing in the list may be arranged for production in one or other of the plants.

Chairman.

How do you expect to implement these schemes ?

Dr. Sankaran.

There should first be prepared an agreed blue print, as it were, of the quantities of various end-products which are required and can be produced. Then place this before capitalists and financiers and suggest that they distribute these plants among themselves and locate them in different provinces of the country according to availability of raw materials and other considerations. Enquiries, however, have shown that the various schemes were not sufficiently attractive to capitalists for several reasons. The only alternative is that the State (Central and Provincial) should undertake the responsibility. It is usual for the Governments to refer all industrial schemes to the departments of Industries. However in recent times they have not shown sufficient enthusiasm for carrying out schemes prepared by other departments. Under such circumstances departments other than industries department should be prepared to execute them on their own responsibility. In fact this has been done in some cases. For example, the Central Ministry of Communications has its own telephone factory, the Railway Board has its own locomotive factory, the Agriculture Ministry its own tractor organisation, the Mysore health department its own pyrethrum production plants. Recently the Penicillin plant is placed under the admini trative and technical direction of an officer of the Health Department of the Government Bombay. It will be equally appropriate if any schemes of the Environmental Hygiene Co mittee are handled by the Department under which it is administratively placed. It shoul course be pointed out that the appropriate technical talent is harnessed for execution. I scheme is a predominently engineering one, an engineer should be made responsible thoug may be administratively placed in a Health Department headed by members of the Me Profession. This may superficially appear as uncommon and revolutionary. However, revolutions are happening silently. For long chemists were unwelcome among Medical Rese workers, and to this day an officer of the Medical Research Department must have a registe medical qualification. However, there is now a preponderance of Medical Research wo possessing qualifications other than medical. Engineers in the Medical Department are r rare phenomenon but nevertheless they do exist. If engineers are employed in a Medica partment, one fails to understand the objection to their doing an engineering job. It m mentioned that in Western countries, especially the U. S. A., Engineers are extensively emp for example in the Department of Agriculture. The gigantic Nitrogen fixation and phos plants in the U. S. A. have been sponsored and developed under the Federal Departm Agriculture. By such means healthy regard and respect of other professions will devel rivalries and suspicions disappear.

Chairman.

Do we possess the technical " know how " to produce ?

Dr. Sankaran.

I am firmly of the opinion that, perhaps with the rare exception of the Atom Bo technical " know how " of all industrially produced commodities especially those of the titive group is available to anyone sufficiently interested and willing to overcome diffic they arise. Prof. Subrahmanyan will bear witness to this, for in 1941 the expert op India, both foreign and Indian, with regard to " Freeze dessication " was that we do not p even sufficient information. However, the All India Institute of Hygiene and Public Healt built a plant in less than three months and its second trial run falsified in the experts' opinio Regarding vitamin production a similar opinion was held as recently as 1946 and schemes for production were unceremoniously shelved. Even a suggestion of a deputation to other countries to acquire this lacking information was also turned down. However, my investigation in Europe and America during 1946 to 1948 convinced me how hopelessly erroneous expert opinion could be. It was even stated that industrialists would not even permit a casual visit to factories. While it is true that there is a certain reticence on the part of industrialists, a human approach has resulted at least in my entry into factories listed in the appendix. In the interests of development of our industries it is very desirable that deputationists returning to India after spending valuable dollars with a doleful story of inaccessibility should meet with deterrent treatment and certainly not elevation to higher key positions as being experienced and realistic.

There has also been in the last half a decade a development that has immense possibilities for India. The entire secret of the collosal chemical industry of Germany is now available in its entirety. There are thousands of published reports on these and several ton-loads of detailed working instruction, blue prints of plants, flow sheets, etc., available in the archives of British and. U. S. Governments and available to every one for scrutiny and at no cost. I have secured over 400 of such reports and microfilms of thousands of documents.

Chairman.

Can we secure machinery and equipment for these factories ?

Dr. Sankaran.

Yes, sir. One of the important things that I did during my deputation was to explore the availability of equipment. You will notice that I have given in the list (appended herewith) the capital costs involved. These figures were obtained from consulting engineers and chemical plant manufacturers.

Chairman.

How about deliveries ?

Dr. Sankaran.

My enquiries showed that many plants are available ex-stock and in no case was a delivery quoted beyond two years. Most plants can be secured under one year.

There is also another source for equipment. U. S. Government has several billion dollars orth of surplus fully-equipped plants of which I have examined over a dozen that are in excelnt condition and available for as little as even 10 cents in the dollar. Even this 10 cents need ly be paid by instalments spread over several years. These plants are still there and well rth investigation.

We had also another source as reparations from Germany. India has been allotted a small ount. I have seen some of these plants and they are not in as good condition as the American lus plants. However, since they cost us nothing they are quite welcome. Recent newsr reports seem to indicate a revision of the dismantling policy and we may not get our due e.

At the present moment we seem to be in a particularly advantageous position of being in a ers market ". The difficulties in the way seem to be only economic and tightness of the y market. With a system of priorities for food and health programme it should not at difficult to allocate 10 crores of rupees. We often hear of hundreds of crores planned to be on development schemes.

STRIAL PLANTS FOR PRODUCING SYNTHETIC " FOODS ", PHARMACEUTICALS, INSECTICIDES, PLANT AND ANIMAL HORMONES, VITAMINS, ETC.

Description.	Capital Costs. Rs. lakhs.
it juice and Vit. C concentrates. Orange juice straight and concentrated, Amla syrup, guava syrup, jams, tomato juice and ketchup, canned vegetable and fruits. Some of these for export o earn a good return on investment.	25
d sacharification using soft wood and paddy husk. Glucose, ethanol and fusel o l, food yeast, fat yeast and edible fats.	25
n products. Starch dextrin, glucose liquie and crystalline corn steep liquor, corn oil, cattle feed, molassess, butanol, isopropanol, acetone.	50
4. *Sorbitol.* From glucose above sorbitol, spans, tweens and emulsifiers, sorbose.	25
5. *Deep fermentation Plant.* Penicillin, streptomycin, riboflavin, ergosterol.	50
6. *High pressure synthesis.* Ammonia, nitric acid, urea, methanol, formaldehyde, plastics phenol formaldehyde, urea formaldehyde.	100

Description.	Capital Costs. Rs. lakhs.
7. *Electrochemical and associated.* Chlorine and alkali (including salt from sea water). With benzone, chloro-benzene, D. D. T., synthetic Phenol, aniline, salicylic acid. Hydrogen a by-product to give HCI. Chlorinated solvents. Metallic sodium.	50
8. *Calcium carbide, cyanamide and liquid air.* Acetylene for welding, oxygen, nitrogen, rare gases, nitrogenous fertilisers.	50
9. *Organic chemicals from carbide.* Acetaldehyde, acetic acid and anhydride, other higher aldehydes, ketones, acids, glycos, glycoll thers, others and oxides, esters.	50
10. *Organic nitrogen chemicals from Calcium cynamaide.* Dicyandiamide, calcium cyanide, guanidine, Thiourea, melanine resins and plastics.	25
11. *Phosphorus and phosphates.* Yellow phosphorus, red phosphorus, phosphoric acid, oxides of phosphorus, chlorides of phosphorus, phosphorus oxichloride, phosphates, superphosphates.	50
12. *Coke oven plant and by-product recovery.* Coke, tar, gas Ammonia, sulphur, Tar distillation, aromatic hydrocarbons, benzene, toluene, napthalene, anthracene, phenol, pyridine, pitch.	100
13. *Petroleum cracking.* Organic chemicals from ethylene, Ethyl alcohol, acetone, ethyl methyl ketone, glycol, propylene, propyl alcohol, butyl alcohol, ethylene chlorhydrin, ethylene dichloride, ethylene oxide, ethylene cyanohydrin, acrylic acid and acrylic esters, aromatic hydrocarbons, toluene, benzene.	100
14. *Synthetic pharmaceuticals, vitamins, hormones, etc.* Acetylsalicy'ic acid, salicyl saliculic acid, para amino salicylic acid, para amino, benzoic acid, antipyrin, phenacitin, piramidon, urotropin saloe, atophan, novacain, novalgin, ovipan, amidone, forbitutrates, luminol, veronal, bro-mural, demoral, dolautin, asparin, cardiazole, coramine, ophedrine, benze-drine, phenothiazine, yatren, io-dohydroxy quinolene, sulphuric acid, salyr-gan, neosalnarsan, neosilversalvarson, myosalvarson, solusalvarson, acety-larson, stiburia, solustibosan, miracil, sulphamilanide, sulphathiazole, sul-phamerazine, sulphadiazine, sulphaguanidine, sulphapyridine, morfanil, dia-sone, promin, sulphetrone, promithizole, tibatin, castrix, thiamin, niacin, pyridoxin, pantothenic acid, biotin, ascorbic acid, methylnapthaquinone, niosterol, calciferol, tocopherol, Deroxy corticosteron, thyromin, adrenalin, testesterone, pro-gesterone, follikulin, prolactin, stilberterol, phenoxyacetic acid, indolacetic acid, persiton.	75
15. *Fischer Tropsh Synthesis and Synthetic edible fats.* Carbon monoxide and hydrogen synthesis to hydrocarbons, oxidation of strai-ght chain hydrocarbon to fatty acid. Fractionation of fatty acids to suit-able edible ones. Fatty acid combination with glycerol to form edible fats. Emulsion of fats to give synthetic butter.	20
16. *Chemical plant fabrication.* Sheet metal rolling from billets, metal sheets from sandwich billets of mild steel and corrosion restant billets of stainless steel, aluminium etc. Sheet priming for making dishends. Welding oxyacytalene and electrical with x-ray exa-mination of welds. Hydrogen and oxyhydrogen flame cutter. Tube bending, heat exchangers and boiler making. Pressure vessels by forging and pribbon winding. Foundry for small castings, general machine shops, turning, sur-facing, milling, grinding, polishing, production and servicing industrial instru-ments for indicating, recording and controlling, temperature pressure, H flow, and liquid levels. Control equipment mechanical, pneumatic and elec-trical.	2

APPENDIX VI.

(See chapter XVIII, paragraph 10).

Syllabus for the Master of Engineering (Public Health) course at the All-India Institute of Hygiene and Public Health, Calcutta, and the number of hours of instruction therefor.

I.—*Syllabus.*

The course for the Master of Engineering (Public Health) is designed for specialised training in Public Health Engineering. India today is likely to incur a large amount of expenditure on water supplies (both urban and rural), drainage and sewage works, housing, construction of hospitals and sanatoria, construction of factories and the control of malaria by temporary and permanent methods on a large scale, etc. In the past Civil Engineers without any specialised public health training have, as a rule, been employed on such duties and it is well known that on occasions the public health aspects have not been fully appreciated. The need for a properly trained public health engineering service has been recognised for some time and it is expected that engineers who have qualified in this course will be in demand in Provincial and State Government Departments, in municipalities and other organisations in India.

The limits of the subjects for the course of studies in M. E. (Public Health) are as follows :—

(i) Sanitary Bacteriology.

Bacterial environment, metabolism, carbon and nitrogen cycles. The role of bacteria Collection of samples of water, sewage, soil, air, milk, etc. Sterilisation.

(2) Sanitary Biology and Chemistry.

Algae, fresh water biology, typical organisms of sewage, sludges, activated sludge, trickling filters etc. River polution and beach pollution and their effects. Life of animals, insects, etc., concerned in the transmission of important diseases. Disinfection, fumigation, disinfestation. Elementary Physiology and Nutrition.

(3) Epidemiology and Public Health Administration.

Origin and spread of the more common diseases such as Malaria, Small-pox, Cholera, Typhoid, Plague, Typhus. Influenza. Tuberculosis, etc. Relation between environment and health. Personal Hygiene and Prophylaxis. Organisation and administration of Public Health in India and elsewhere. Port health and quarantine.

(4) Statistics.

General and vital statistics. Application of statistics to Engineering problems of rainfall, run-off, floods, population growth, sewage and water treatment.

(5) Water supply and sewerage.

(a) Water supply—Design of projects of various types. Methods of preliminary investigation of new projects. Estimates of requirements of water, and the development and conservation of various types of sources of warer supply. Rainfall, run-off and yield of catchments. Statistical analysis of data and estim tion of minimum yield, maximum floods, etc. Ground water. Relation between geology and water supplies. Yield and development of wells and tube wells. Design and construction of river intakes, storage works, clear water and service reservoirs, balancing tanks, stand pipes, pumping stations, etc. Design of pumping plant, air lift systems etc. Distribution systems, pressures and capacity. Specification and construction of water works, pipe lines and auxiliaries. Plumbing. Hot water supply. Economics and maintenance of water works.

(b) Drainage and sewerage—Design and investigation of sewerage and drainage projects. Estimation of sewage, infiltration of ground water and storm water from data on population, soil, intensity and duration of storms etc. Hydraulics and design of separate sewers, combined sewers and drains, syphons, separators, manholes, silt

pits, etc. Ventilation, cleansing and maintenance of drains and sewers. Design of sewage pumping stations and equipment. House drainage.

(6) Theory of water purification and sewage treatment.

Wholesome water. Standards for public and industrial use. Quality of water and sewage. Chemical and bacteriological analysis and their significance. Bio-chemical oxygen demand and its determination. Principles of sedimentation, co-agulation, control of algae, filtration, aeration, taste and odour control, disinfection of water and sewage effluents. Water softening. Corrosion control and incrustation control. Removal of iron, manganese, etc. Sedimentation of sewage. Anaerobic digestion of sludge. Sludge gas collection and utilisation. Activated sludge process. Trickling filter. Stability tests for sewage effluents and determination of their strength. River pollution problems. Analysis and specification of chemical used in water purification and sewage treatment. Manurial value of sewage. Dilution and irrigation. Elementary analysis of gases.

(7) Design of water purification and sewage treatment plants.

(a) Design and construction of structures for screening, aeration; chemical treatment (co-agulation), rapid and slow sand filtration. disinfection, softening, deforrisation, etc. Water laboratories.

(b) Design and construction of structures for screening, grit removal, sedimentation and skimming, of septic, Imhoff, sludge digestion and humus tanks ; trickling filters, contact beds, activated sludge ; vaccum, filters, etc. Disposal of effluents on land and in waters. Estimating river pollution and safe loads for self-purification. Sewage laboratories.

(8) General sanitation.

(a) Street cleansing, refuse collection and disposal by various methods, including incineration and composting.

(b) Ventilation, air-conditioning, heating, cooling, noise and dust control, smoke abatement. Methods of air and gas analysis, dust counting etc.

(c) Principles of village and town planning, zoning, healthful housing and slum clearance.

(d) Type plans, construction and sanitation of hospitals, schools, slaughter, houses, diaries, food and drink establishments, markets, eating establishments, swimming pools, disinfection and disinfestation, etc. Rat-proof and fly-proof and mosquito proof construction. Sanitary survey and reporting.

(e) Rural sanitation problems. Latrines and trenching grounds.

(9) Malaria Engineering.

Life history and habits of vectors, malaria surveys. Recurrent, naturalistic and permanent methods of controlling larvæ and adult mosquitoes. Design of anti-malarial drains in various circumstances. Canalisation. Flushing. River training. Clearing. Sub-soil drainage. Filling. Adult spray methods. Construction of sprayers. Preparation of larvicides and insecticides. Screening of houses. Relation between engineering construction, irrigation and malaria. Malaria control for engineering projects, etc.

(10) (a) Industrial Hygiene.

Elementary Physiological Hygiene. More detailed class and laboratory instruction on ventilation, air-conditioning, dust, smoke and fume control, occupational risks, abnormal atmospheres, safety measures, comfort, etc.

(b) Disposal of industrial wastes.

Nature and treatment of wastes produced at various stages in the leading industries in India, such as textiles, paper, brewing, tanning, dyeing metals etc.

II.—*Numbers of hours of instruction.*

Subject	Lectures.	Practicals.	Total Hours	Given by
1. General Sanitation . . .	40	..	40	Sanitary Engineering Department.
2. Water Supply and Sewerage .	41	126	167	Do.
3. Sanitary Chemistry and Biology	41	93	134	Do.
4. Malaria Engineering . .	17	16	33	Do.
5. Theory of Water Purification and Sewage Treatment.	30	..	30	Do.
6. Water Purification and Sewage treatment works.	36	72	108	Do.
7. Sanitary laboratory . . .	..	91	91	Do.
8. Industrial wastes . . .	10	..	10	Do.
9. Stream Sanitation . . .	8	..	8	Do.
10. Demonstration and Field trips .	..	200	200	Do.
11. Sanitary Bactoriology and Parasitology.	30	52	82	Other departments.
2. Public Health Administration .	20	8	28	Do.
3. Physiology and Nutrition . .	7	..	7	Do.
. Industrial Hygiene . . .	21	12	33	Do.
. Communicable diseases . .	28	..	28	Do.
. Statistics	23	46	69	Do.
	352	516+200	1,068	

APPENDIX VII.

(See Chapter XVIII, paragraph 20).

Syllabus for the certificate in Public Health Engineering at the All-India Institute of Hy[illegible] and Public Health, Calcutta, and the number of hours of instruction therefor.

I.—*Syllabus.*

The course is designed to impart instruction in elemenatry principles and techniques in Public Health Engineering. The training will consist of academic instruction for 3 months followed by an examination and a further assigned practical training for 3 months. The limits of subjects of studies for the course are as under :—

A. Introductory.

Scope of public health and sanitation, ancient and modern theories. Elementary physiology and nutrition.

B. (*a*) Elementary bactoriology, environment, biology, metabolism and functions of bacteria, bacteria of water, sewage, milk, air, soil, use of microscope.

(*b*) Biology of water purification and sewage disposal, river pollution, fish life, etc.

(*c*) Biology—Mosquitoes, flies, rats, fleas, ticks, lice, sandflies, ankylostoma.

(*d*) Chemistry of water purification and sewage treatment, including disinfection.

C. Communicable diseases.

Malaria, dangue, plague, cholera, typhoid, dysentery. Hookworm, Tuberculosis, Pneumonia, influenza, Small-pox, chickenpox, etc. Epidemics and epidemic control, Public Health Administration.

D. Statistics.

General Statistics, mean, standard deviation, rates, etc.

E. Application.

Hydraulics, Water supply and purification, design, etc. Latrines, sewerage, sewa[illegible] disposal, drainage, refuse disposal, plumbling.

Food and milk preservation, transport, handling, restaurants, markets, slaughter-hou[illegible] etc.

Town planning, zoning, housing, lighting, ventilation, dust control, factories etc. Malaria control.

Rat control, fly control, rural sanitation, fairs and festivals disinfection, etc.

II.—*Number of hours of instruction.*

Subjects	Lectures	Practicals	Tota[illegible]
1. General sanitation	15	..	[illegible]
2. Water supply and sewage disposal	38	34	[illegible]
3. Sanitary chemistry and biology	20	41	[illegible]
4. Communicable diseases	12	..	[illegible]
5. Statistics	16	..	[illegible]
6. Microbiology	9	16	[illegible]
7. Public Health administration	2	..	[illegible]
8. Physiology and nutrition	6	..	6
9. Visits and demonstration	..	65	65
	118	156	274

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